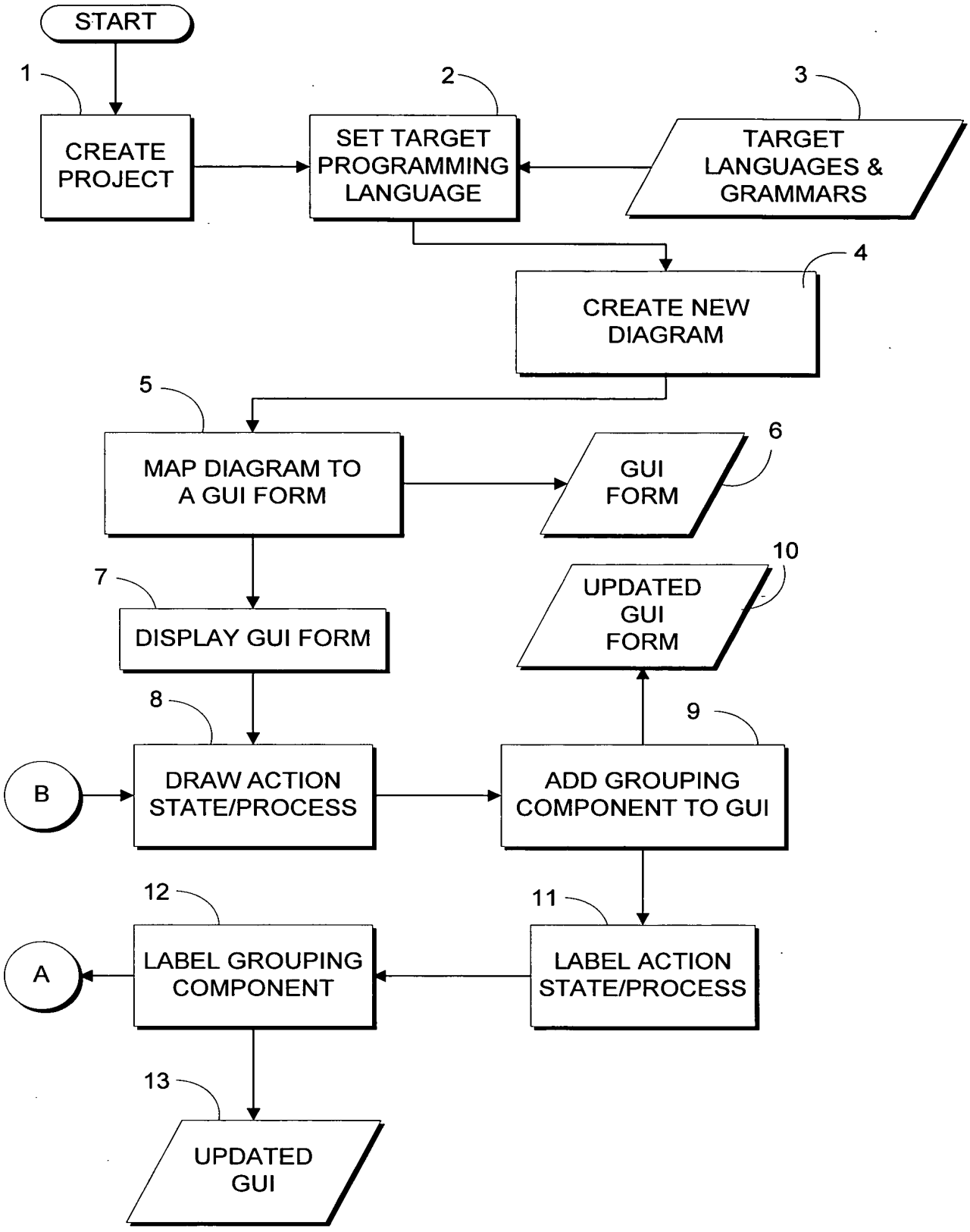
START
1
CREATE PROJECT
2
SET TARGET PROGRAMMING LANGUAGE
3
TARGET LANGUAGES & GRAMMARS
4
CREATE NEW DIAGRAM
5
MAP DIAGRAM TO A GUI FORM
6
GUI FORM
7
DISPLAY GUI FORM
8
B
DRAW ACTION STATE/PROCESS
9
ADD GROUPING COMPONENT TO GUI
10
UPDATED GUI FORM
11
LABEL ACTION STATE/PROCESS
12
A
LABEL GROUPING COMPONENT
13
UPDATED GUI

FIG. 1A

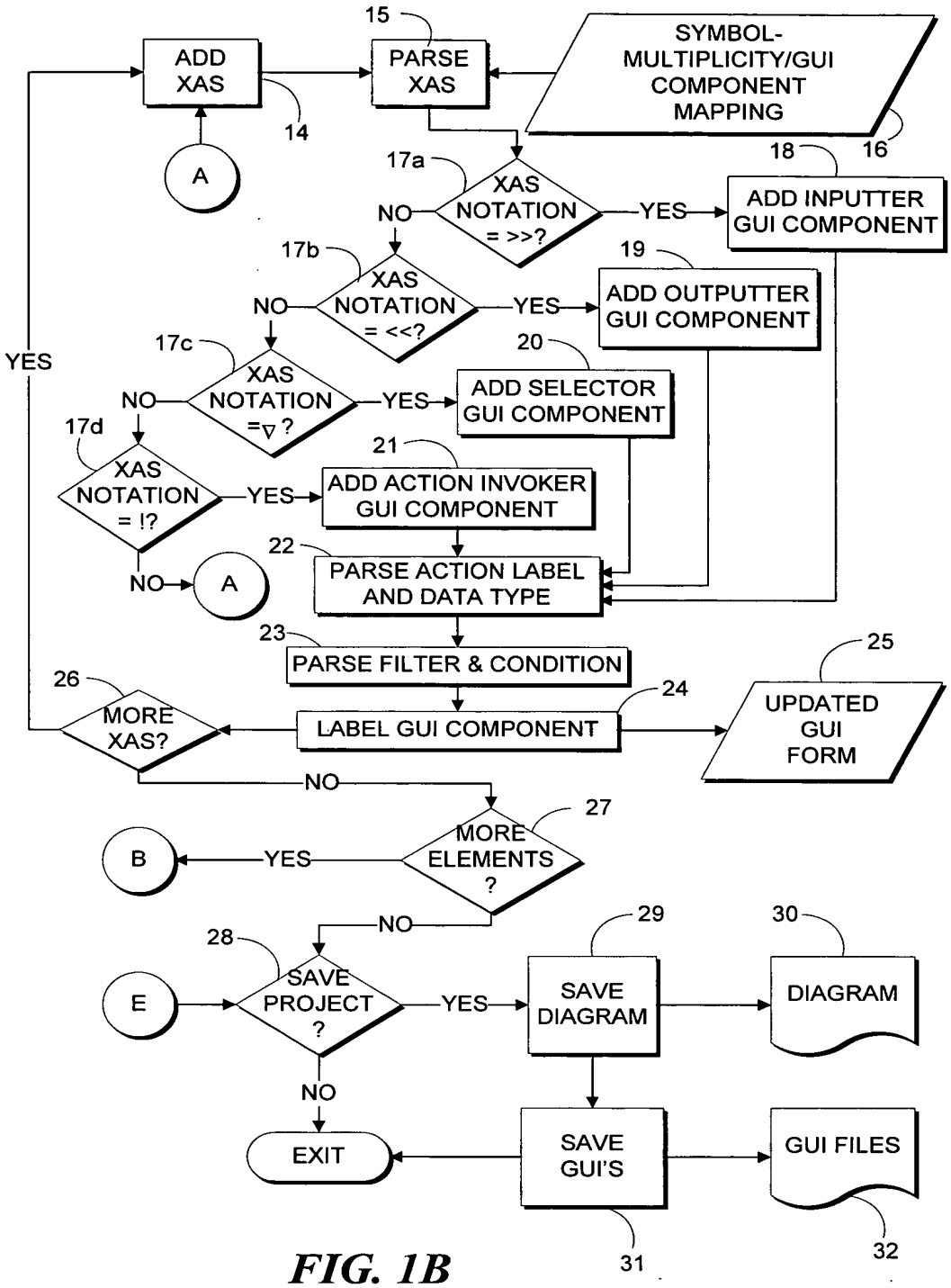
ADD XAS
14
A
15
PARSE XAS
SYMBOL-MULTIPLICITY/GUI COMPONENT MAPPING
16
17a
XAS NOTATION = >>?
NO
YES
18
ADD INPUTTER GUI COMPONENT
17b
XAS NOTATION = <<?
NO
YES
19
ADD OUTPUTTER GUI COMPONENT
17c
XAS NOTATION =∇ ?
NO
YES
20
ADD SELECTOR GUI COMPONENT
17d
XAS NOTATION = !?
YES
21
ADD ACTION INVOKER GUI COMPONENT
NO
A
22
PARSE ACTION LABEL AND DATA TYPE
23
PARSE FILTER & CONDITION
24
LABEL GUI COMPONENT
25
UPDATED GUI FORM
26
MORE XAS?
YES
NO
27
MORE ELEMENTS ?
B
YES
NO
28
SAVE PROJECT ?
E
YES
29
SAVE DIAGRAM
30
DIAGRAM
NO
EXIT
SAVE GUI'S
31
GUI FILES
32

FIG. 1B

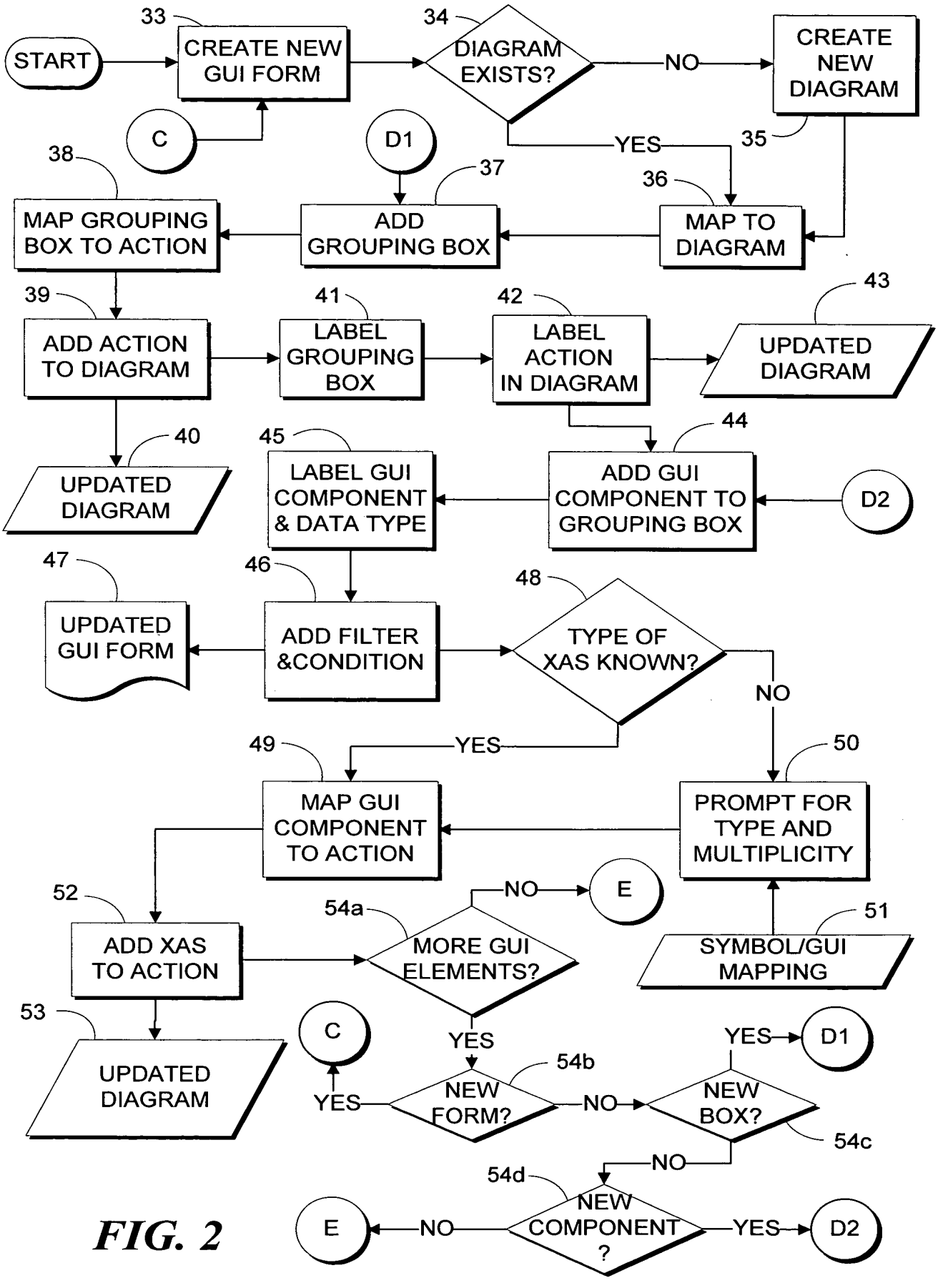
START
33
CREATE NEW GUI FORM
34
DIAGRAM EXISTS?
NO
CREATE NEW DIAGRAM
35
YES
C
D1
38
37
36
MAP GROUPING BOX TO ACTION
ADD GROUPING BOX
MAP TO DIAGRAM
39
41
42
43
ADD ACTION TO DIAGRAM
LABEL GROUPING BOX
LABEL ACTION IN DIAGRAM
UPDATED DIAGRAM
40
45
44
UPDATED DIAGRAM
LABEL GUI COMPONENT & DATA TYPE
ADD GUI COMPONENT TO GROUPING BOX
D2
47
46
48
UPDATED GUI FORM
ADD FILTER &CONDITION
TYPE OF XAS KNOWN?
NO
YES
49
50
MAP GUI COMPONENT TO ACTION
PROMPT FOR TYPE AND MULTIPLICITY
52
NO
E
54a
51
ADD XAS TO ACTION
MORE GUI ELEMENTS?
SYMBOL/GUI MAPPING
53
C
YES
YES
D1
UPDATED DIAGRAM
54b
YES
NEW FORM?
NO
NEW BOX?
54c
NO
54d
E
NO
NEW COMPONENT ?
YES
D2

FIG. 2

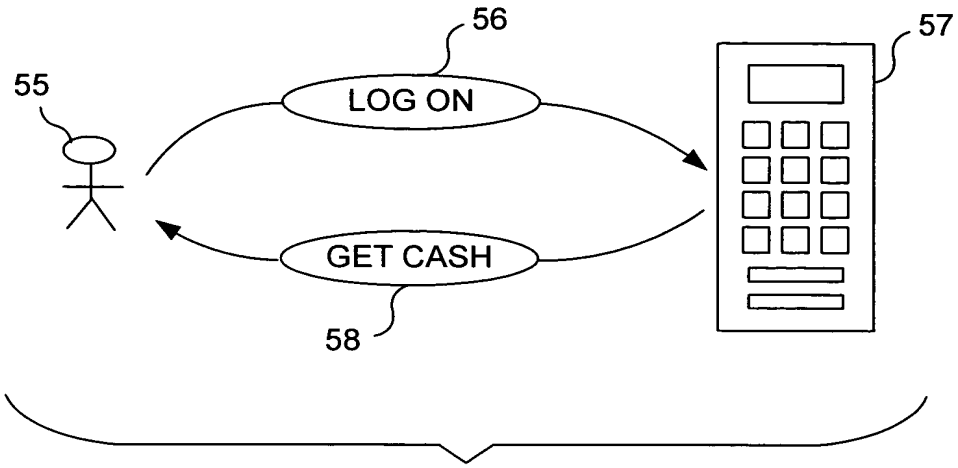

FIG. 3
PRIOR ART

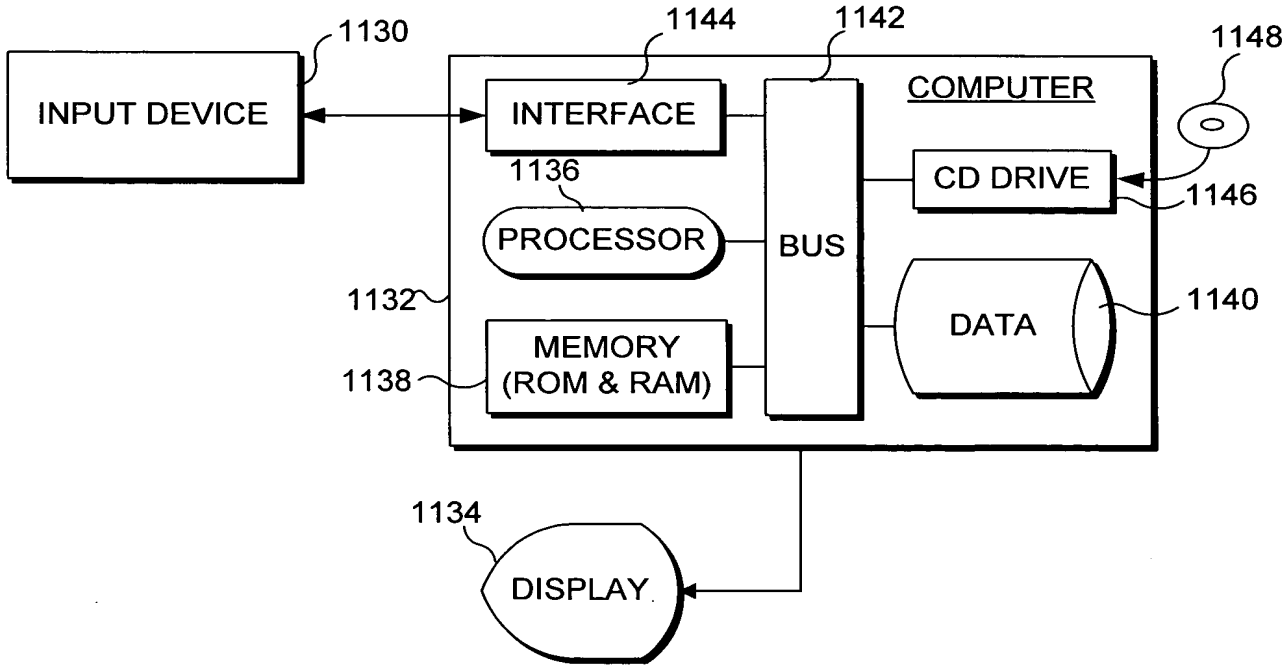

FIG. 11

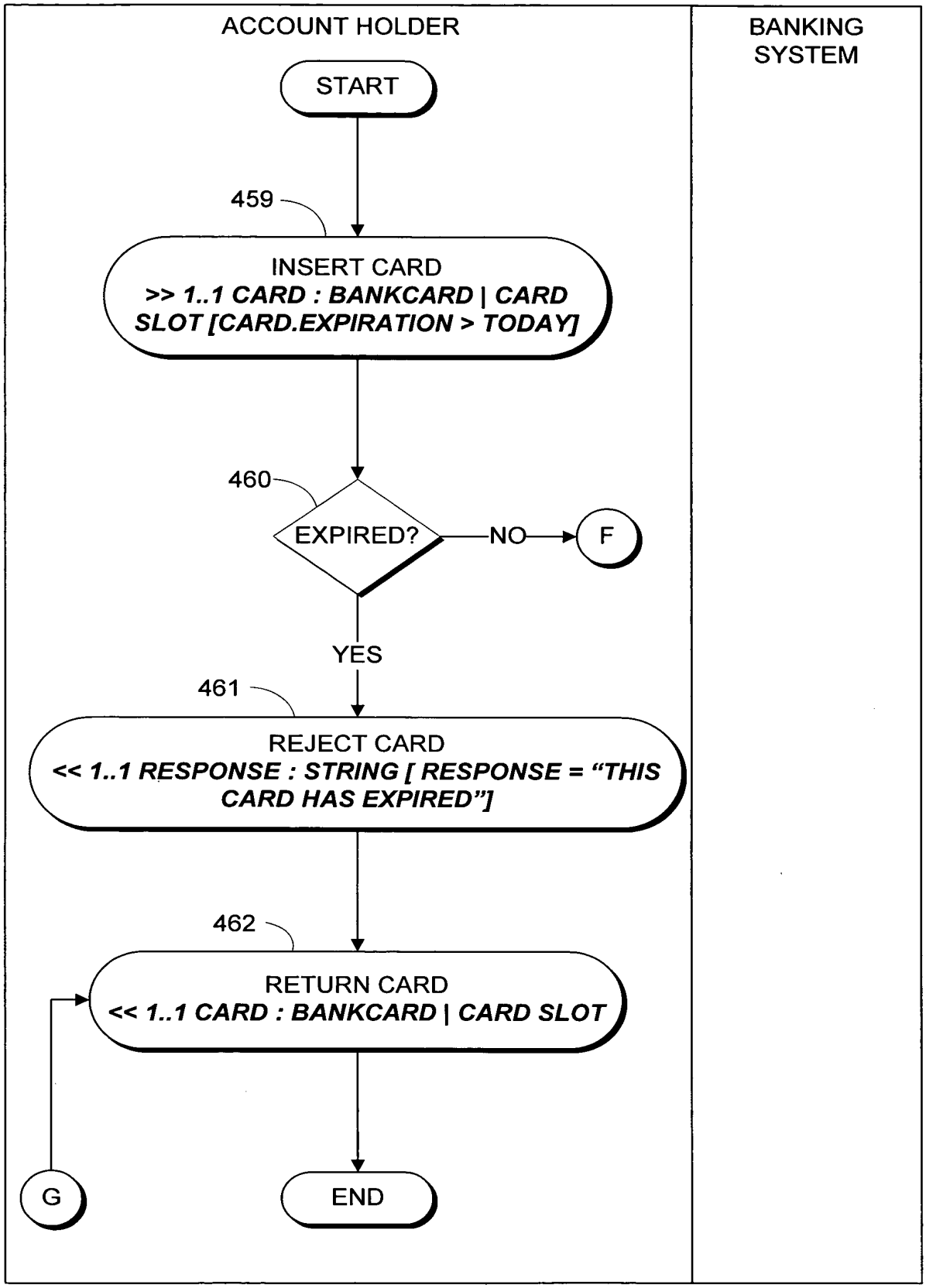
ACCOUNT HOLDER
BANKING SYSTEM
START
459
INSERT CARD
>> 1..1 CARD : BANKCARD | CARD SLOT [CARD.EXPIRATION > TODAY]
460
EXPIRED?
NO
F
YES
461
REJECT CARD
<< 1..1 RESPONSE : STRING [RESPONSE = "THIS CARD HAS EXPIRED"]
462
RETURN CARD
<< 1..1 CARD : BANKCARD | CARD SLOT
G
END

FIG. 4A

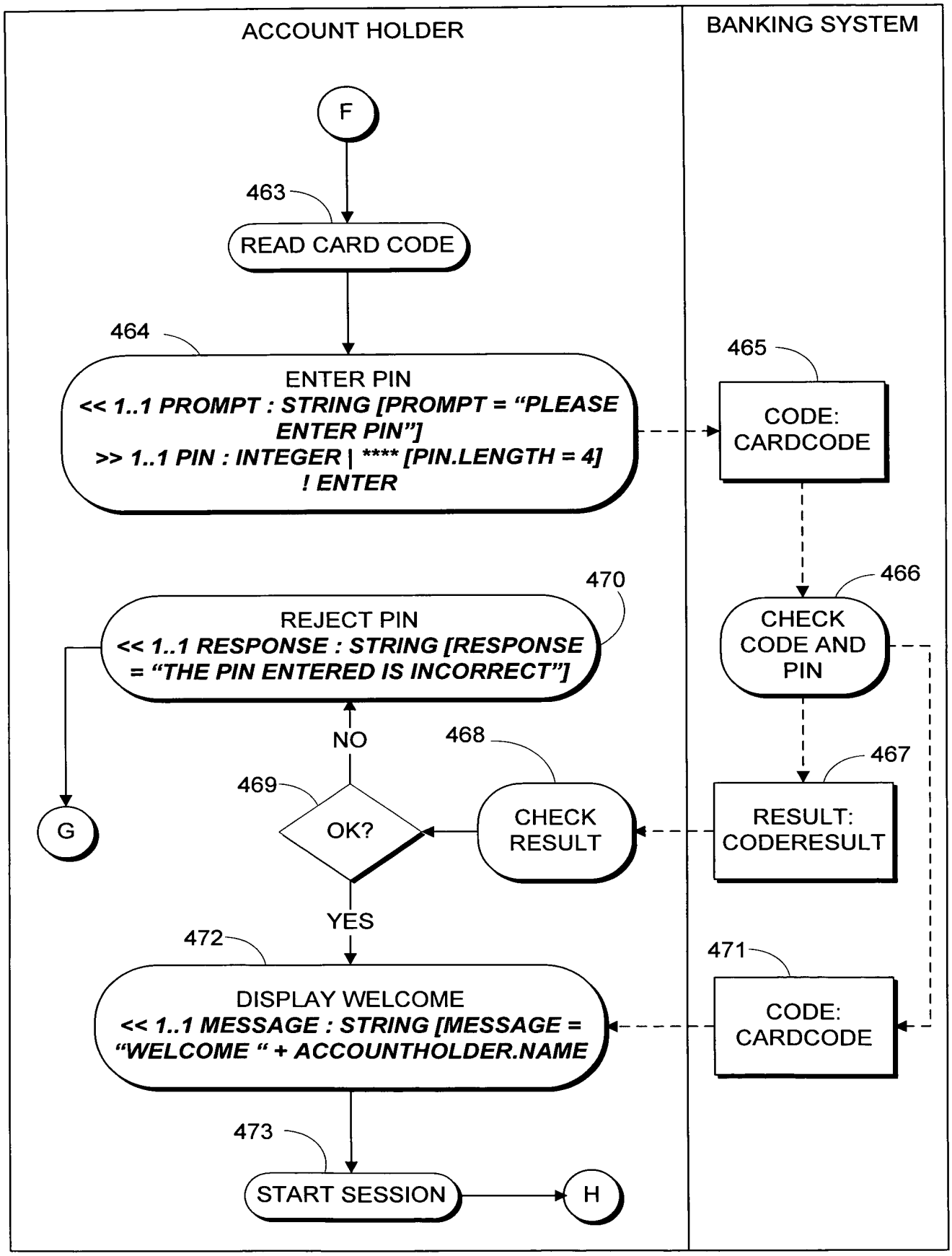
ACCOUNT HOLDER
BANKING SYSTEM
F
463
READ CARD CODE
464
ENTER PIN
<< 1..1 PROMPT : STRING [PROMPT = "PLEASE ENTER PIN"]
>> 1..1 PIN : INTEGER | **** [PIN.LENGTH = 4]
! ENTER
465
CODE: CARDCODE
466
CHECK CODE AND PIN
467
RESULT: CODERESULT
468
CHECK RESULT
469
OK?
NO
YES
470
REJECT PIN
<< 1..1 RESPONSE : STRING [RESPONSE = "THE PIN ENTERED IS INCORRECT"]
G
471
CODE: CARDCODE
472
DISPLAY WELCOME
<< 1..1 MESSAGE : STRING [MESSAGE = "WELCOME " + ACCOUNTHOLDER.NAME
473
START SESSION
H

FIG. 4B

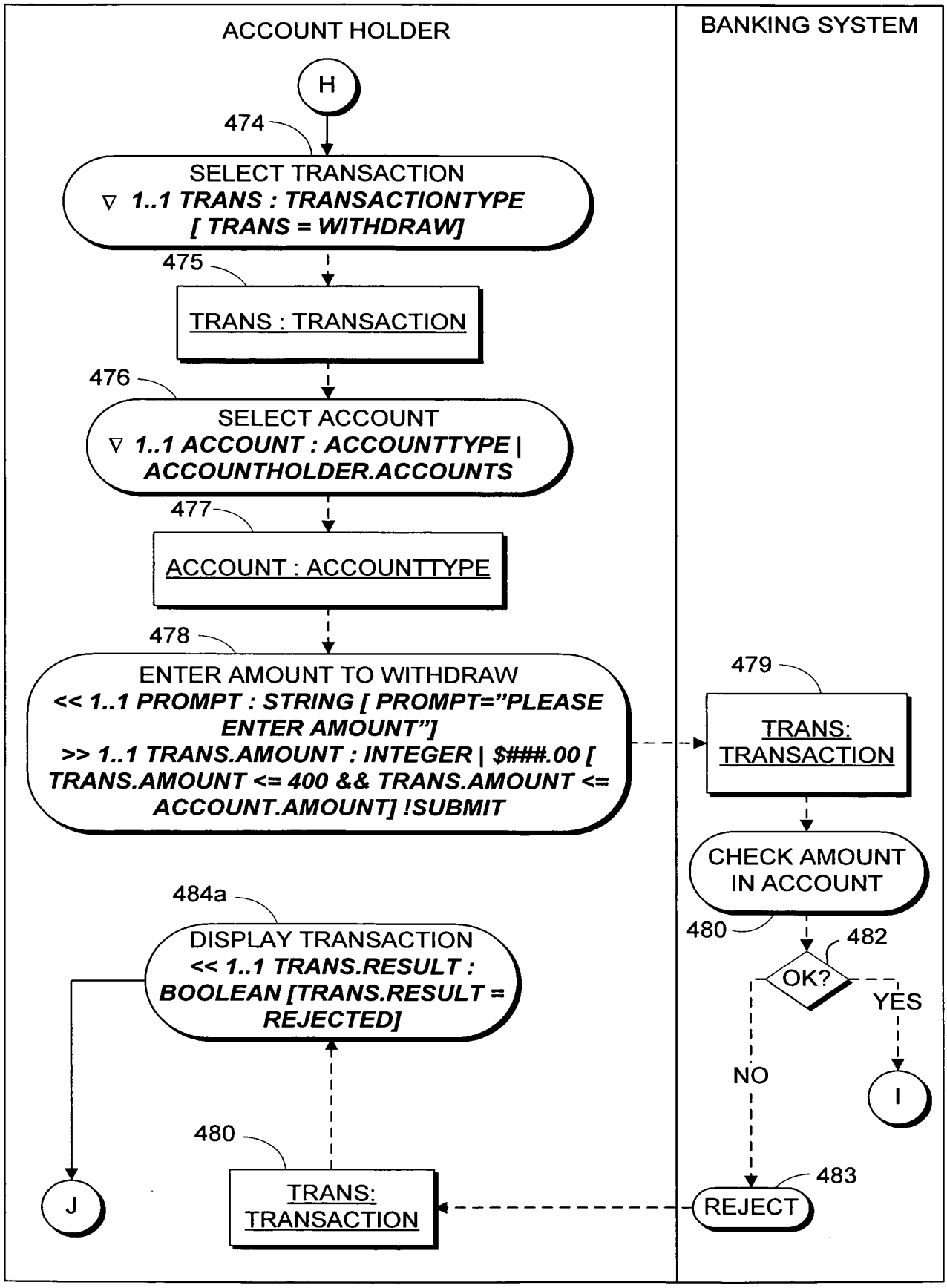
ACCOUNT HOLDER
BANKING SYSTEM
H
474
SELECT TRANSACTION
▽ 1..1 TRANS : TRANSACTIONTYPE
[TRANS = WITHDRAW]
475
TRANS : TRANSACTION
476
SELECT ACCOUNT
▽ 1..1 ACCOUNT : ACCOUNTTYPE |
ACCOUNTHOLDER.ACCOUNTS
477
ACCOUNT : ACCOUNTTYPE
478
ENTER AMOUNT TO WITHDRAW
<< 1..1 PROMPT : STRING [PROMPT="PLEASE ENTER AMOUNT"]
>> 1..1 TRANS.AMOUNT : INTEGER | $###.00 [TRANS.AMOUNT <= 400 && TRANS.AMOUNT <= ACCOUNT.AMOUNT] !SUBMIT
479
TRANS: TRANSACTION
CHECK AMOUNT IN ACCOUNT
480
482
OK?
YES
NO
I
484a
DISPLAY TRANSACTION
<< 1..1 TRANS.RESULT : BOOLEAN [TRANS.RESULT = REJECTED]
480
TRANS: TRANSACTION
483
REJECT
J

FIG. 4C

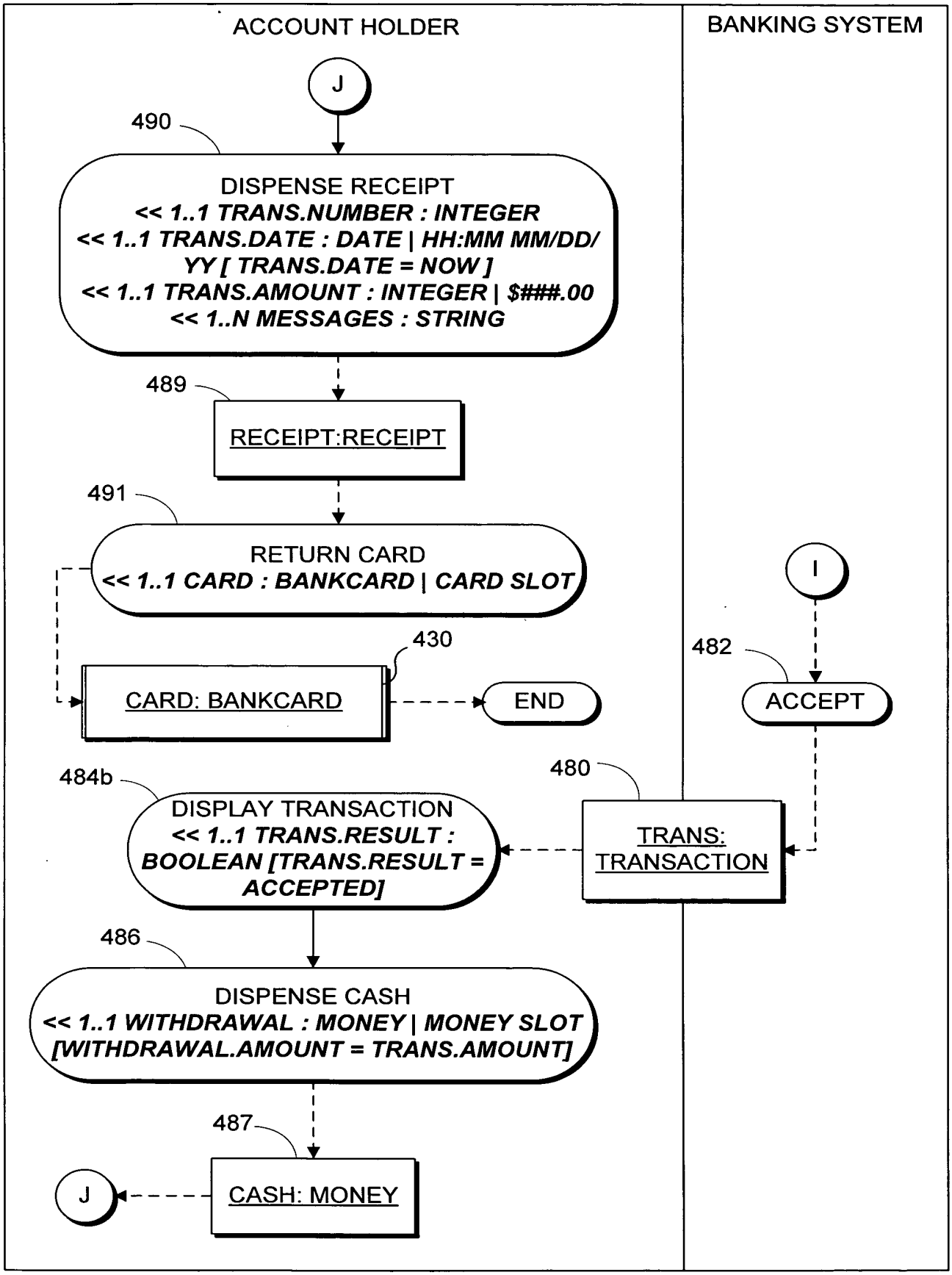
ACCOUNT HOLDER
BANKING SYSTEM
J
490
DISPENSE RECEIPT
<< 1..1 TRANS.NUMBER : INTEGER
<< 1..1 TRANS.DATE : DATE | HH:MM MM/DD/YY [TRANS.DATE = NOW]
<< 1..1 TRANS.AMOUNT : INTEGER | $###.00
<< 1..N MESSAGES : STRING
489
RECEIPT:RECEIPT
491
RETURN CARD
<< 1..1 CARD : BANKCARD | CARD SLOT
430
CARD: BANKCARD
END
I
482
ACCEPT
480
TRANS: TRANSACTION
484b
DISPLAY TRANSACTION
<< 1..1 TRANS.RESULT : BOOLEAN [TRANS.RESULT = ACCEPTED]
486
DISPENSE CASH
<< 1..1 WITHDRAWAL : MONEY | MONEY SLOT
[WITHDRAWAL.AMOUNT = TRANS.AMOUNT]
487
CASH: MONEY
J

FIG. 4D

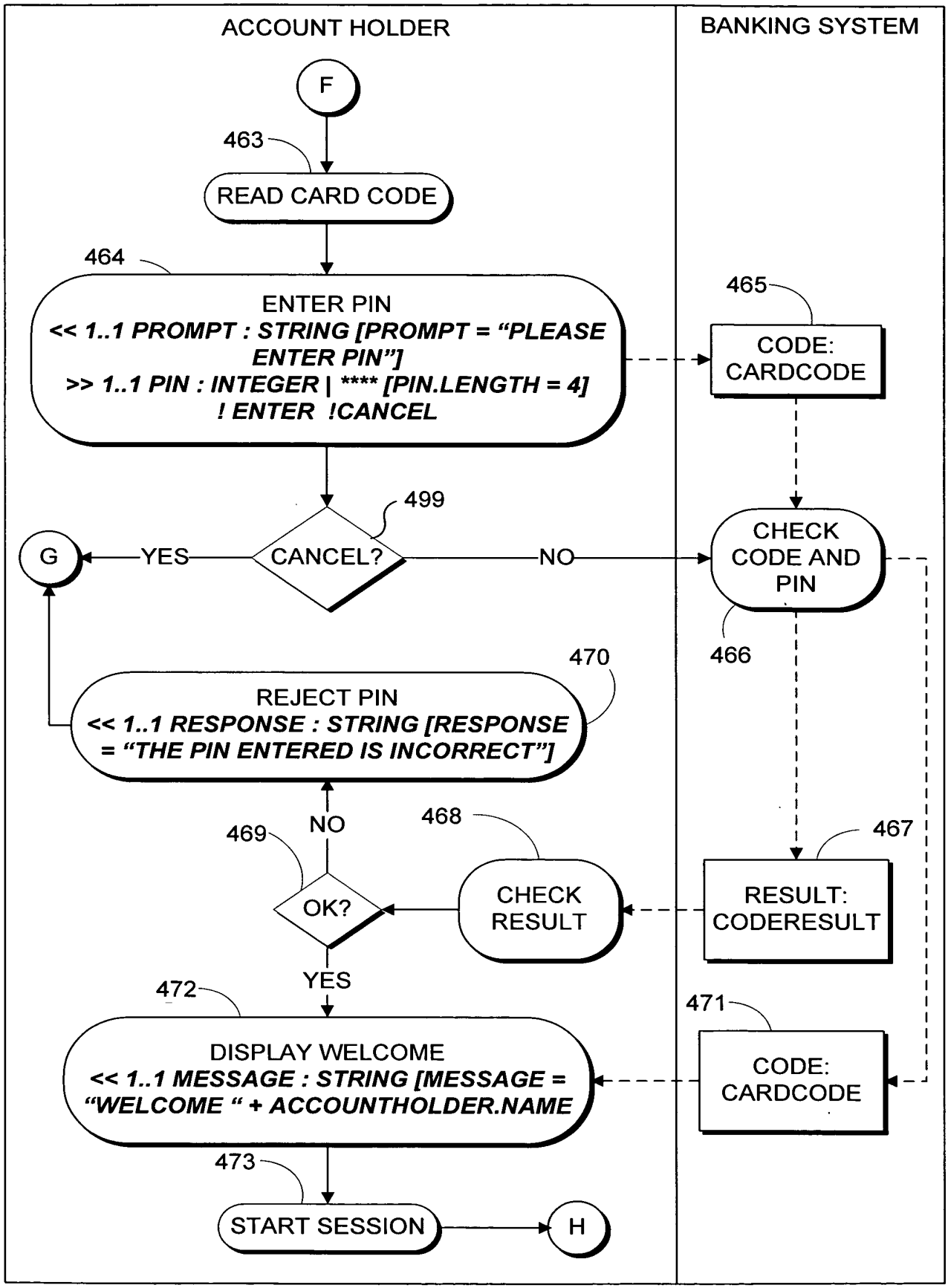
ACCOUNT HOLDER
BANKING SYSTEM
F
463
READ CARD CODE
464
ENTER PIN
<< 1..1 PROMPT : STRING [PROMPT = "PLEASE ENTER PIN"]
>> 1..1 PIN : INTEGER | **** [PIN.LENGTH = 4]
! ENTER !CANCEL
465
CODE: CARDCODE
499
G
YES
CANCEL?
NO
CHECK CODE AND PIN
466
470
REJECT PIN
<< 1..1 RESPONSE : STRING [RESPONSE = "THE PIN ENTERED IS INCORRECT"]
NO
469
468
467
OK?
CHECK RESULT
RESULT: CODERESULT
YES
472
471
DISPLAY WELCOME
<< 1..1 MESSAGE : STRING [MESSAGE = "WELCOME " + ACCOUNTHOLDER.NAME
CODE: CARDCODE
473
START SESSION
H

FIG. 4E

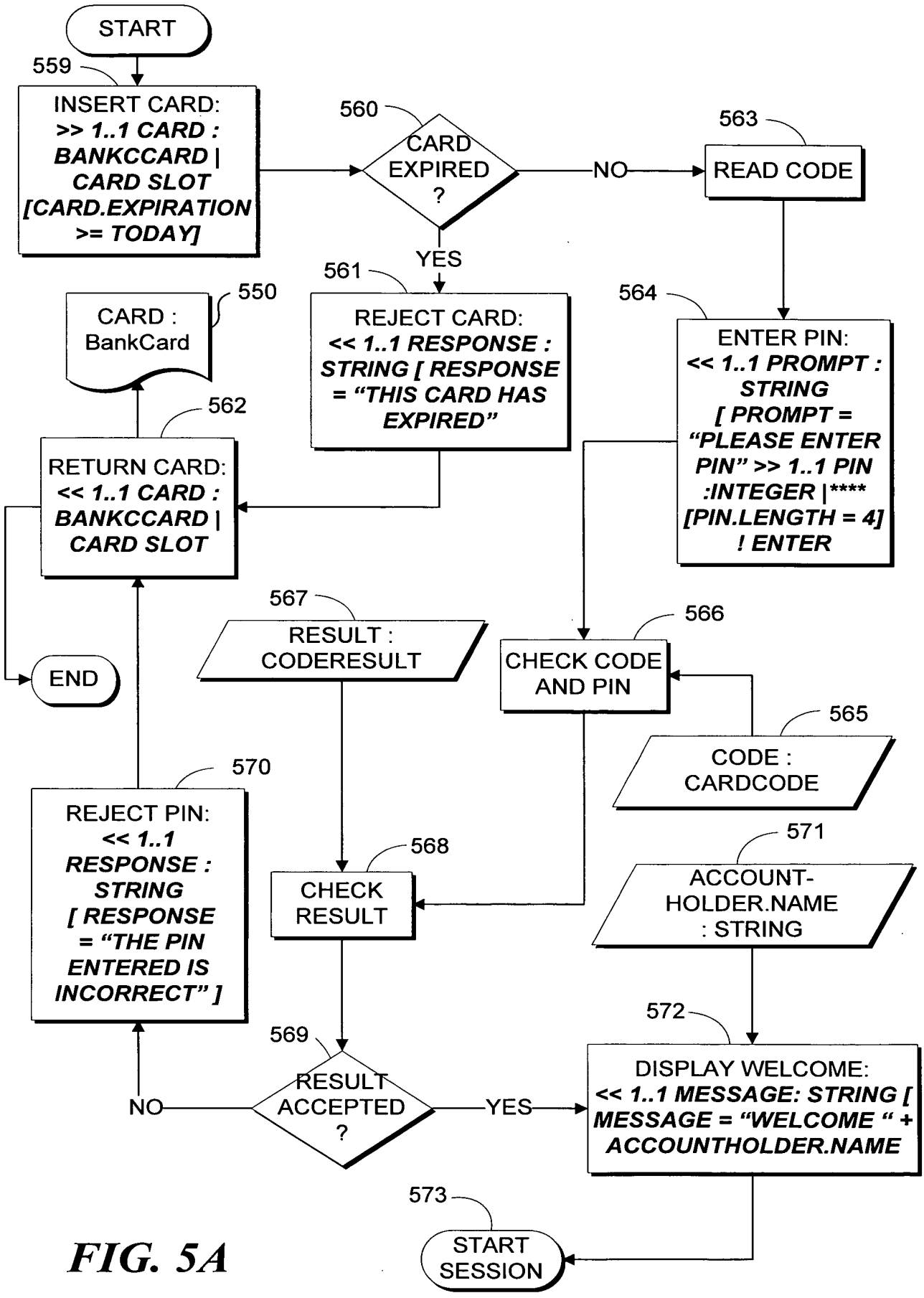
START
559
INSERT CARD:
>> 1..1 CARD : BANKCCARD | CARD SLOT [CARD.EXPIRATION >= TODAY]
560
CARD EXPIRED ?
NO
563
READ CODE
YES
561
REJECT CARD:
<< 1..1 RESPONSE : STRING [RESPONSE = "THIS CARD HAS EXPIRED"
564
ENTER PIN:
<< 1..1 PROMPT : STRING [PROMPT = "PLEASE ENTER PIN" >> 1..1 PIN :INTEGER |**** [PIN.LENGTH = 4] ! ENTER
550
CARD : BankCard
562
RETURN CARD:
<< 1..1 CARD : BANKCCARD | CARD SLOT
END
567
RESULT : CODERESULT
566
CHECK CODE AND PIN
565
CODE : CARDCODE
570
REJECT PIN:
<< 1..1 RESPONSE : STRING [RESPONSE = "THE PIN ENTERED IS INCORRECT"]
568
CHECK RESULT
571
ACCOUNT-HOLDER.NAME : STRING
572
569
RESULT ACCEPTED ?
NO
YES
DISPLAY WELCOME:
<< 1..1 MESSAGE: STRING [MESSAGE = "WELCOME " + ACCOUNTHOLDER.NAME
573
START SESSION

FIG. 5A

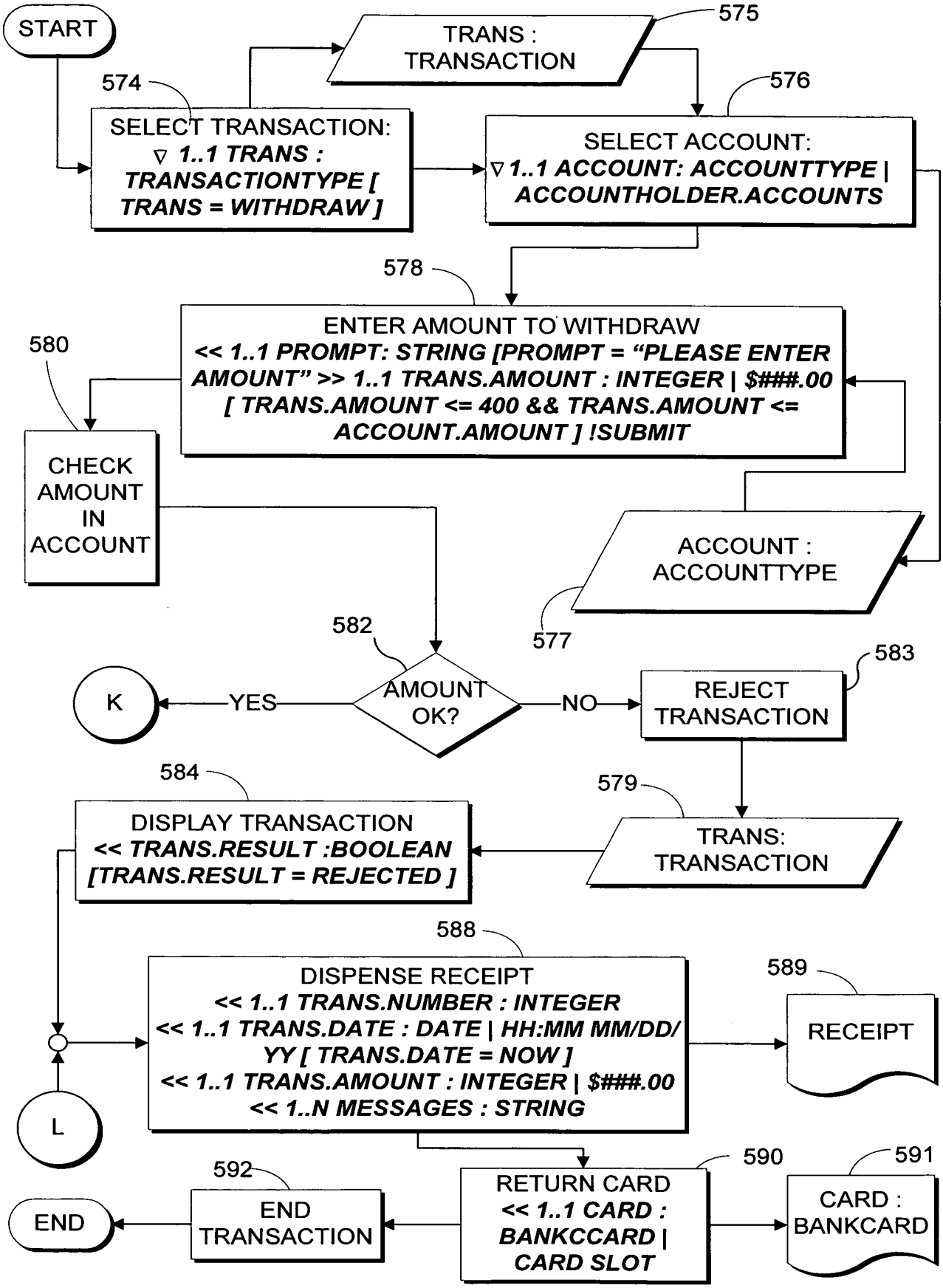
START
TRANS : TRANSACTION
575
574
SELECT TRANSACTION:
▽ 1..1 TRANS : TRANSACTIONTYPE [TRANS = WITHDRAW]
576
SELECT ACCOUNT:
▽ 1..1 ACCOUNT: ACCOUNTTYPE | ACCOUNTHOLDER.ACCOUNTS
578
ENTER AMOUNT TO WITHDRAW
<< 1..1 PROMPT: STRING [PROMPT = "PLEASE ENTER AMOUNT" >> 1..1 TRANS.AMOUNT : INTEGER | $###.00 [TRANS.AMOUNT <= 400 && TRANS.AMOUNT <= ACCOUNT.AMOUNT] !SUBMIT
580
CHECK AMOUNT IN ACCOUNT
ACCOUNT : ACCOUNTTYPE
577
582
AMOUNT OK?
YES
K
NO
583
REJECT TRANSACTION
584
DISPLAY TRANSACTION
<< TRANS.RESULT :BOOLEAN [TRANS.RESULT = REJECTED]
579
TRANS: TRANSACTION
588
DISPENSE RECEIPT
<< 1..1 TRANS.NUMBER : INTEGER
<< 1..1 TRANS.DATE : DATE | HH:MM MM/DD/YY [TRANS.DATE = NOW]
<< 1..1 TRANS.AMOUNT : INTEGER | $###.00
<< 1..N MESSAGES : STRING
589
RECEIPT
L
590
591
RETURN CARD
<< 1..1 CARD : BANKCCARD | CARD SLOT
CARD : BANKCARD
592
END TRANSACTION
END

FIG. 5B

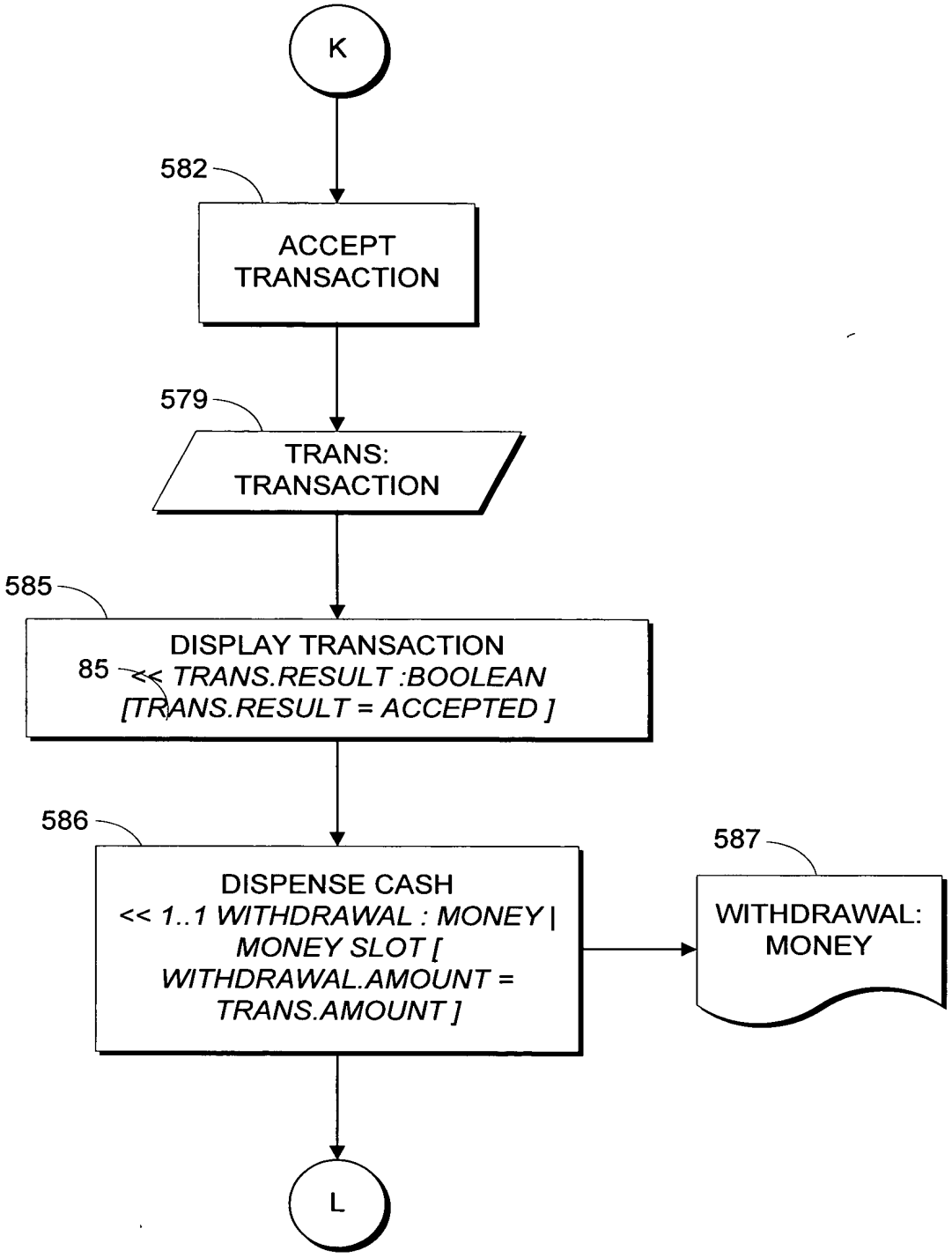
K
582
ACCEPT TRANSACTION
579
TRANS: TRANSACTION
585
DISPLAY TRANSACTION
85
<< TRANS.RESULT :BOOLEAN
[TRANS.RESULT = ACCEPTED]
586
DISPENSE CASH
<< 1..1 WITHDRAWAL : MONEY |
MONEY SLOT [
WITHDRAWAL.AMOUNT =
TRANS.AMOUNT]
587
WITHDRAWAL: MONEY
L

FIG. 5C

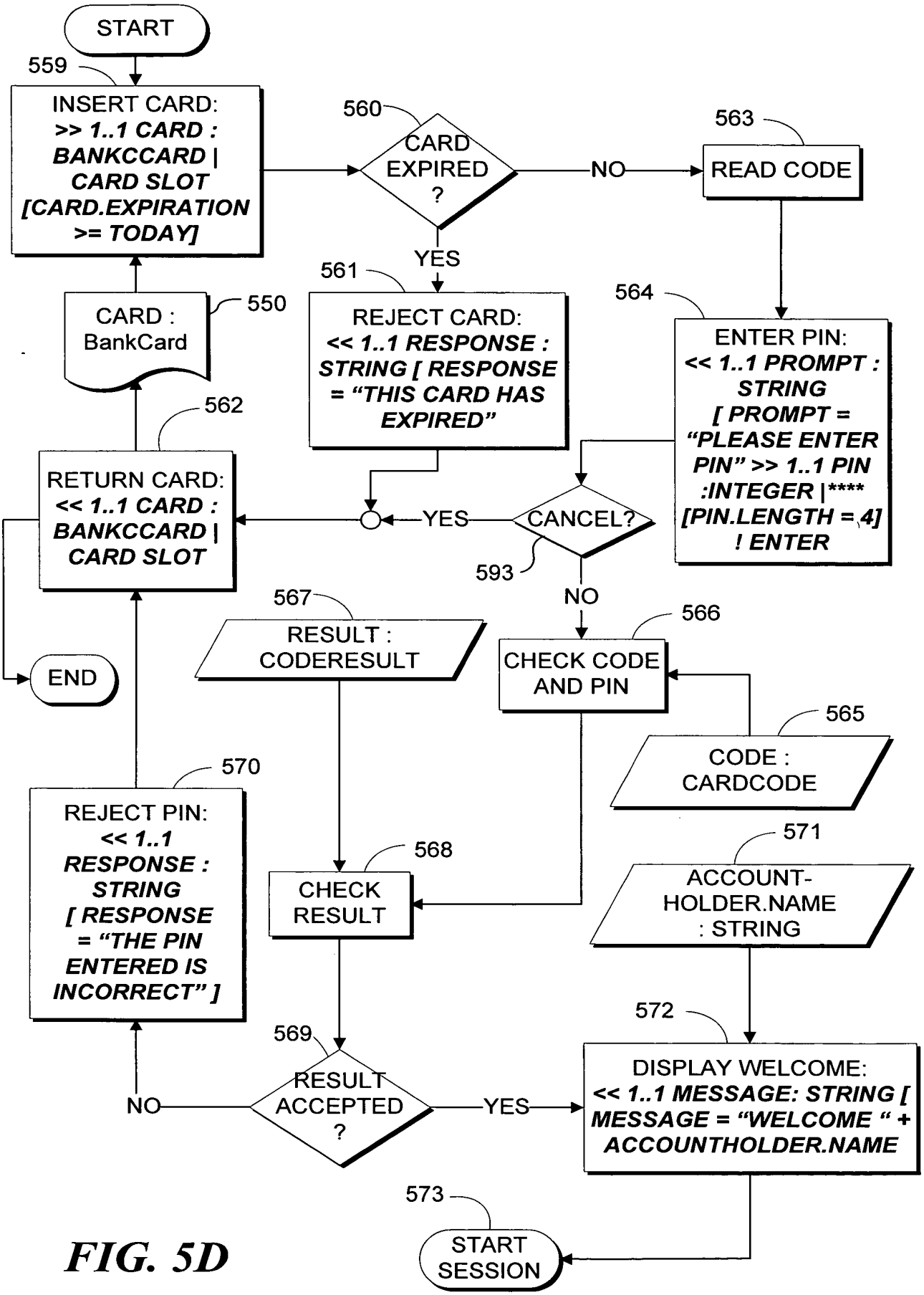
START
559
INSERT CARD:
>> 1..1 CARD : BANKCCARD | CARD SLOT [CARD.EXPIRATION >= TODAY]
560
CARD EXPIRED ?
NO
563
READ CODE
YES
561
REJECT CARD:
<< 1..1 RESPONSE : STRING [RESPONSE = "THIS CARD HAS EXPIRED"
564
ENTER PIN:
<< 1..1 PROMPT : STRING [PROMPT = "PLEASE ENTER PIN" >> 1..1 PIN :INTEGER |**** [PIN.LENGTH = 4] ! ENTER
CARD : BankCard
550
562
RETURN CARD:
<< 1..1 CARD : BANKCCARD | CARD SLOT
YES
CANCEL?
593
NO
END
567
RESULT : CODERESULT
566
CHECK CODE AND PIN
565
CODE : CARDCODE
570
REJECT PIN:
<< 1..1 RESPONSE : STRING [RESPONSE = "THE PIN ENTERED IS INCORRECT"]
568
CHECK RESULT
571
ACCOUNT-HOLDER.NAME : STRING
569
RESULT ACCEPTED ?
NO
YES
572
DISPLAY WELCOME:
<< 1..1 MESSAGE: STRING [MESSAGE = "WELCOME " + ACCOUNTHOLDER.NAME
573
START SESSION

FIG. 5D

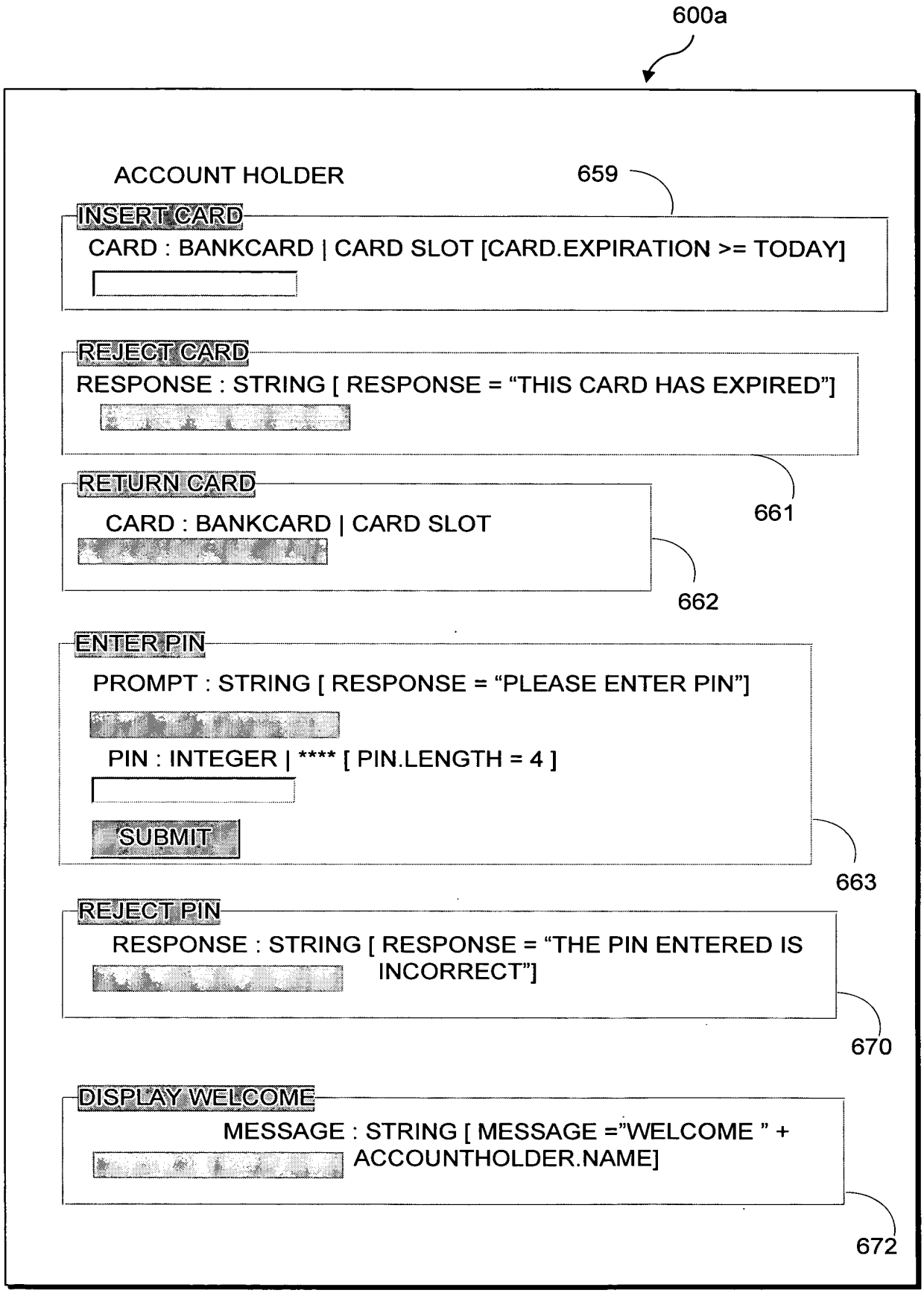
600a
ACCOUNT HOLDER
659
INSERT CARD
CARD : BANKCARD | CARD SLOT [CARD.EXPIRATION >= TODAY]
REJECT CARD
RESPONSE : STRING [RESPONSE = "THIS CARD HAS EXPIRED"]
661
RETURN CARD
CARD : BANKCARD | CARD SLOT
662
ENTER PIN
PROMPT : STRING [RESPONSE = "PLEASE ENTER PIN"]
PIN : INTEGER | **** [PIN.LENGTH = 4]
SUBMIT
663
REJECT PIN
RESPONSE : STRING [RESPONSE = "THE PIN ENTERED IS INCORRECT"]
670
DISPLAY WELCOME
MESSAGE : STRING [MESSAGE ="WELCOME " + ACCOUNTHOLDER.NAME]
672

FIG. 6A

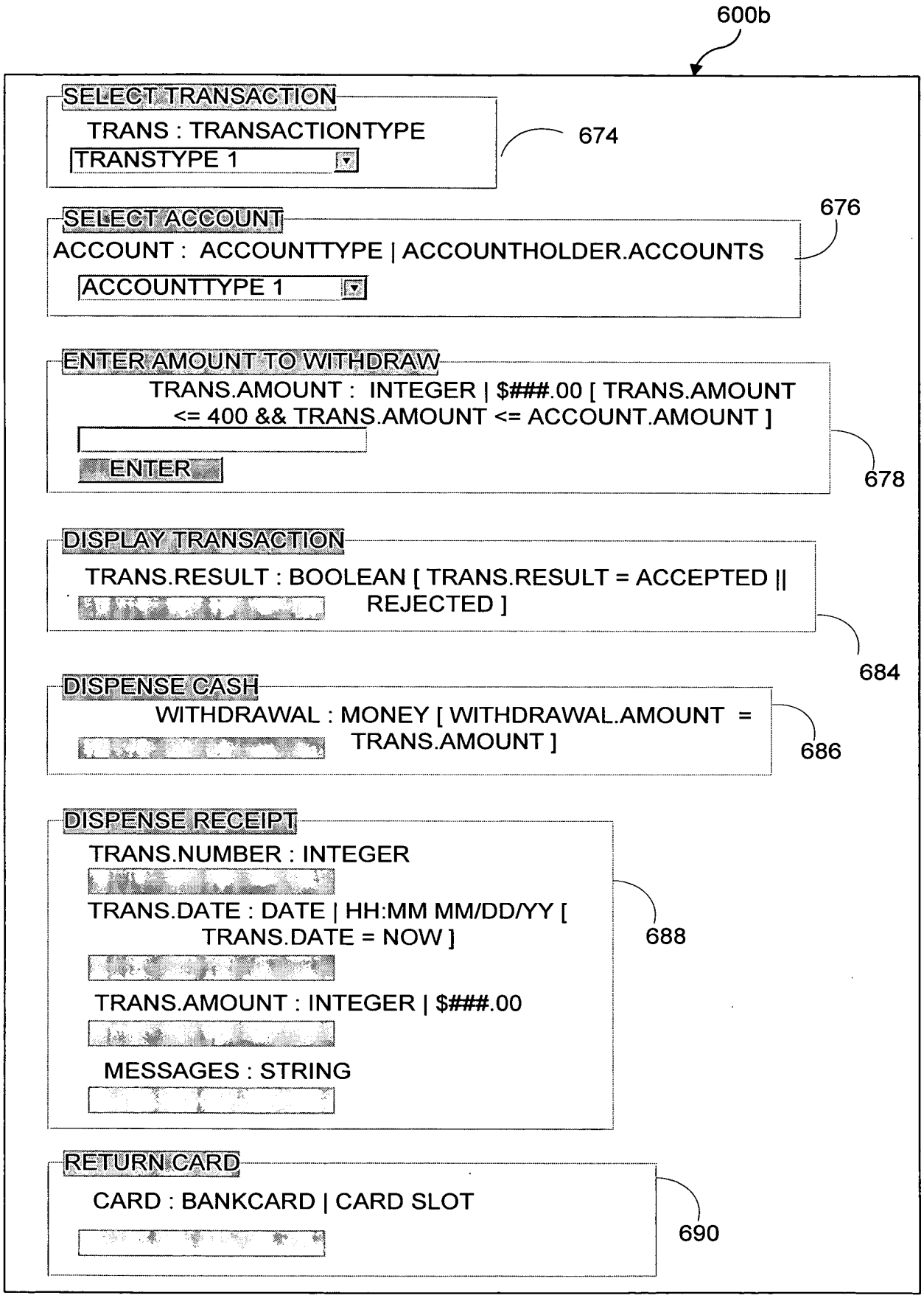
600b
SELECT TRANSACTION
TRANS : TRANSACTIONTYPE
TRANSTYPE 1
674
SELECT ACCOUNT
ACCOUNT : ACCOUNTTYPE | ACCOUNTHOLDER.ACCOUNTS
ACCOUNTTYPE 1
676
ENTER AMOUNT TO WITHDRAW
TRANS.AMOUNT : INTEGER | $###.00 [TRANS.AMOUNT <= 400 && TRANS.AMOUNT <= ACCOUNT.AMOUNT]
ENTER
678
DISPLAY TRANSACTION
TRANS.RESULT : BOOLEAN [TRANS.RESULT = ACCEPTED || REJECTED]
684
DISPENSE CASH
WITHDRAWAL : MONEY [WITHDRAWAL.AMOUNT = TRANS.AMOUNT]
686
DISPENSE RECEIPT
TRANS.NUMBER : INTEGER
TRANS.DATE : DATE | HH:MM MM/DD/YY [TRANS.DATE = NOW]
TRANS.AMOUNT : INTEGER | $###.00
MESSAGES : STRING
688
RETURN CARD
CARD : BANKCARD | CARD SLOT
690

FIG. 6B

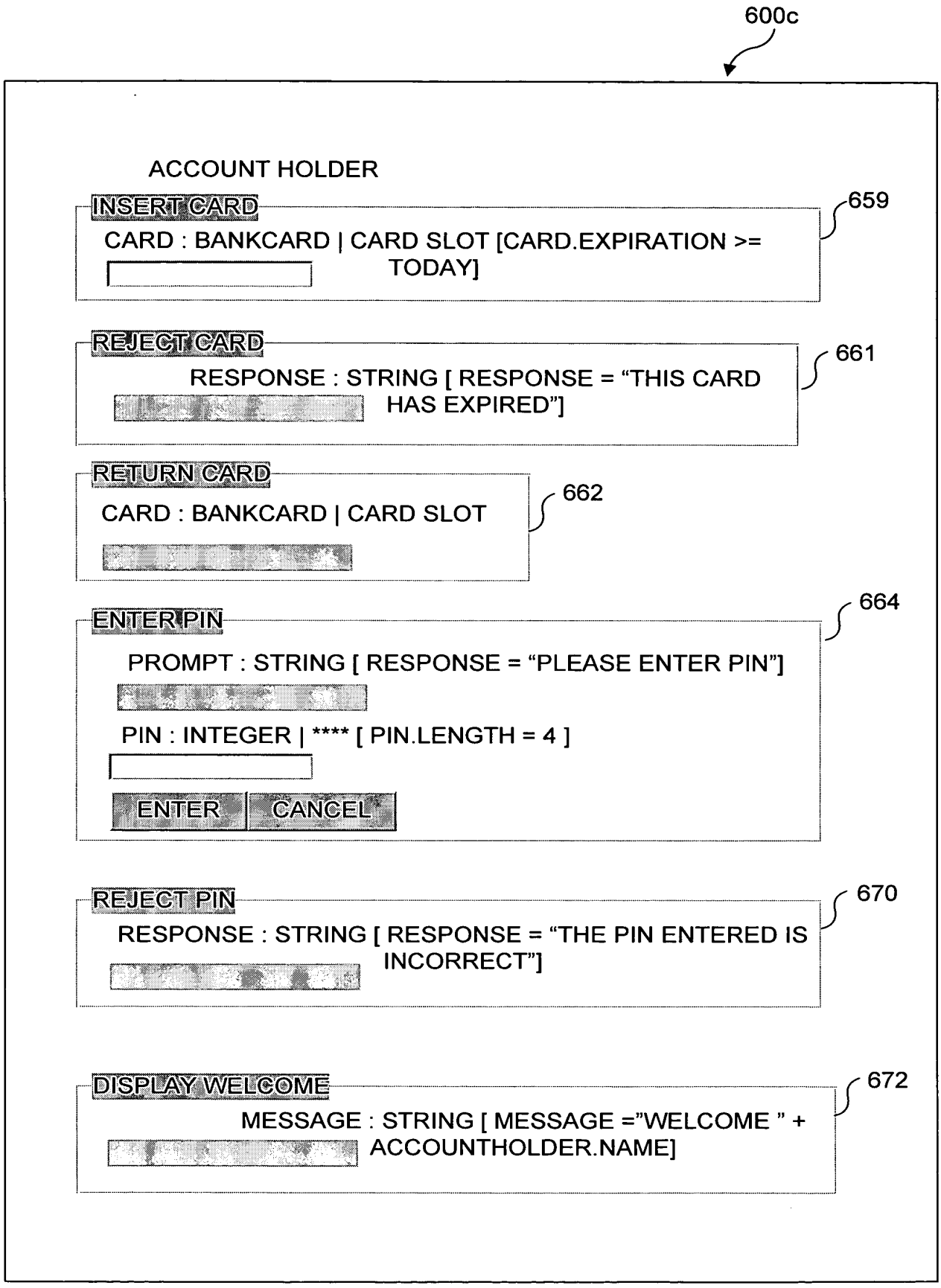
600c
ACCOUNT HOLDER
INSERT CARD
CARD : BANKCARD | CARD SLOT [CARD.EXPIRATION >= TODAY]
659
REJECT CARD
RESPONSE : STRING [RESPONSE = "THIS CARD HAS EXPIRED"]
661
RETURN CARD
CARD : BANKCARD | CARD SLOT
662
ENTER PIN
PROMPT : STRING [RESPONSE = "PLEASE ENTER PIN"]
PIN : INTEGER | **** [PIN.LENGTH = 4]
ENTER
CANCEL
664
REJECT PIN
RESPONSE : STRING [RESPONSE = "THE PIN ENTERED IS INCORRECT"]
670
DISPLAY WELCOME
MESSAGE : STRING [MESSAGE ="WELCOME " + ACCOUNTHOLDER.NAME]
672

FIG. 6C

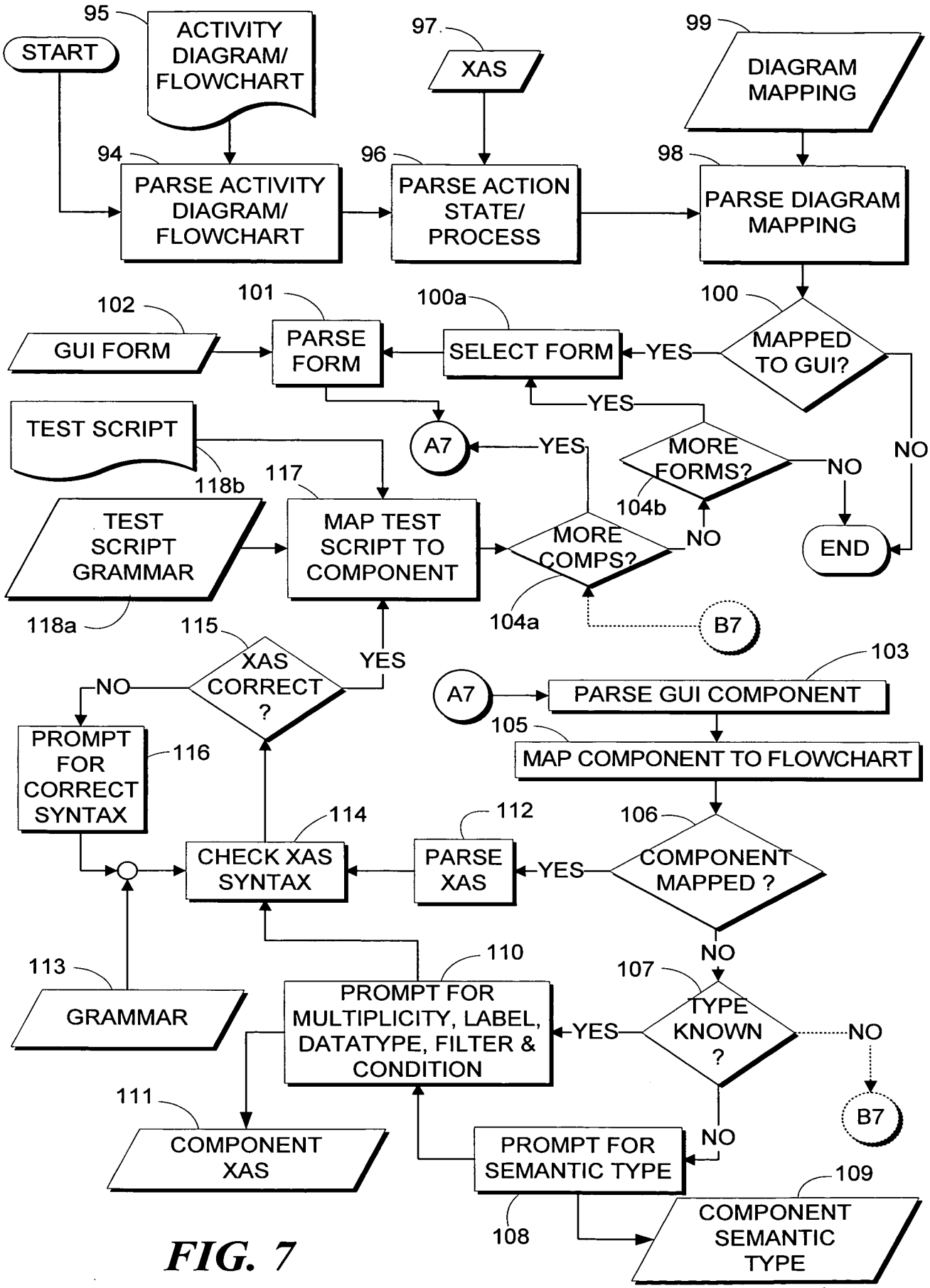
START
95
ACTIVITY DIAGRAM/ FLOWCHART
97
XAS
99
DIAGRAM MAPPING
94
PARSE ACTIVITY DIAGRAM/ FLOWCHART
96
PARSE ACTION STATE/ PROCESS
98
PARSE DIAGRAM MAPPING
100
MAPPED TO GUI?
YES
NO
100a
SELECT FORM
101
PARSE FORM
102
GUI FORM
YES
MORE FORMS?
104b
NO
A7
YES
TEST SCRIPT
118b
117
MAP TEST SCRIPT TO COMPONENT
TEST SCRIPT GRAMMAR
118a
MORE COMPS?
104a
NO
END
B7
115
XAS CORRECT ?
YES
NO
A7
103
PARSE GUI COMPONENT
105
MAP COMPONENT TO FLOWCHART
PROMPT FOR CORRECT SYNTAX
116
106
COMPONENT MAPPED ?
112
PARSE XAS
YES
114
CHECK XAS SYNTAX
NO
113
GRAMMAR
110
107
TYPE KNOWN ?
YES
NO
PROMPT FOR MULTIPLICITY, LABEL, DATATYPE, FILTER & CONDITION
B7
111
COMPONENT XAS
NO
PROMPT FOR SEMANTIC TYPE
109
108
COMPONENT SEMANTIC TYPE

FIG. 7

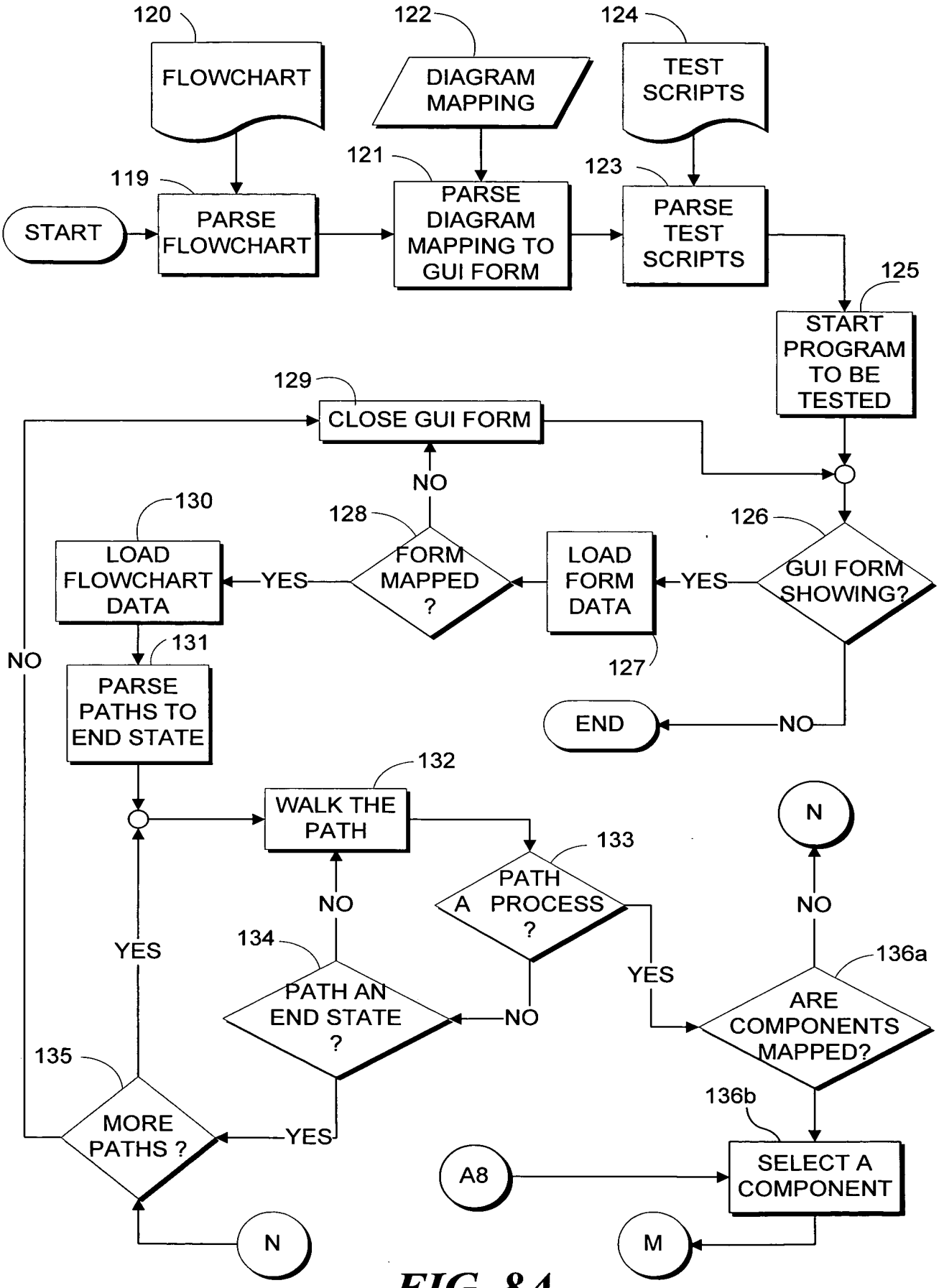
120
FLOWCHART
122
DIAGRAM MAPPING
124
TEST SCRIPTS
119
PARSE FLOWCHART
121
PARSE DIAGRAM MAPPING TO GUI FORM
123
PARSE TEST SCRIPTS
START
125
START PROGRAM TO BE TESTED
129
CLOSE GUI FORM
NO
130
LOAD FLOWCHART DATA
128
FORM MAPPED ?
YES
LOAD FORM DATA
YES
126
GUI FORM SHOWING?
127
NO
END
NO
131
PARSE PATHS TO END STATE
132
WALK THE PATH
133
PATH A PROCESS ?
NO
YES
N
NO
134
PATH AN END STATE ?
NO
YES
136a
ARE COMPONENTS MAPPED?
135
MORE PATHS ?
YES
136b
A8
SELECT A COMPONENT
N
M

FIG. 8A

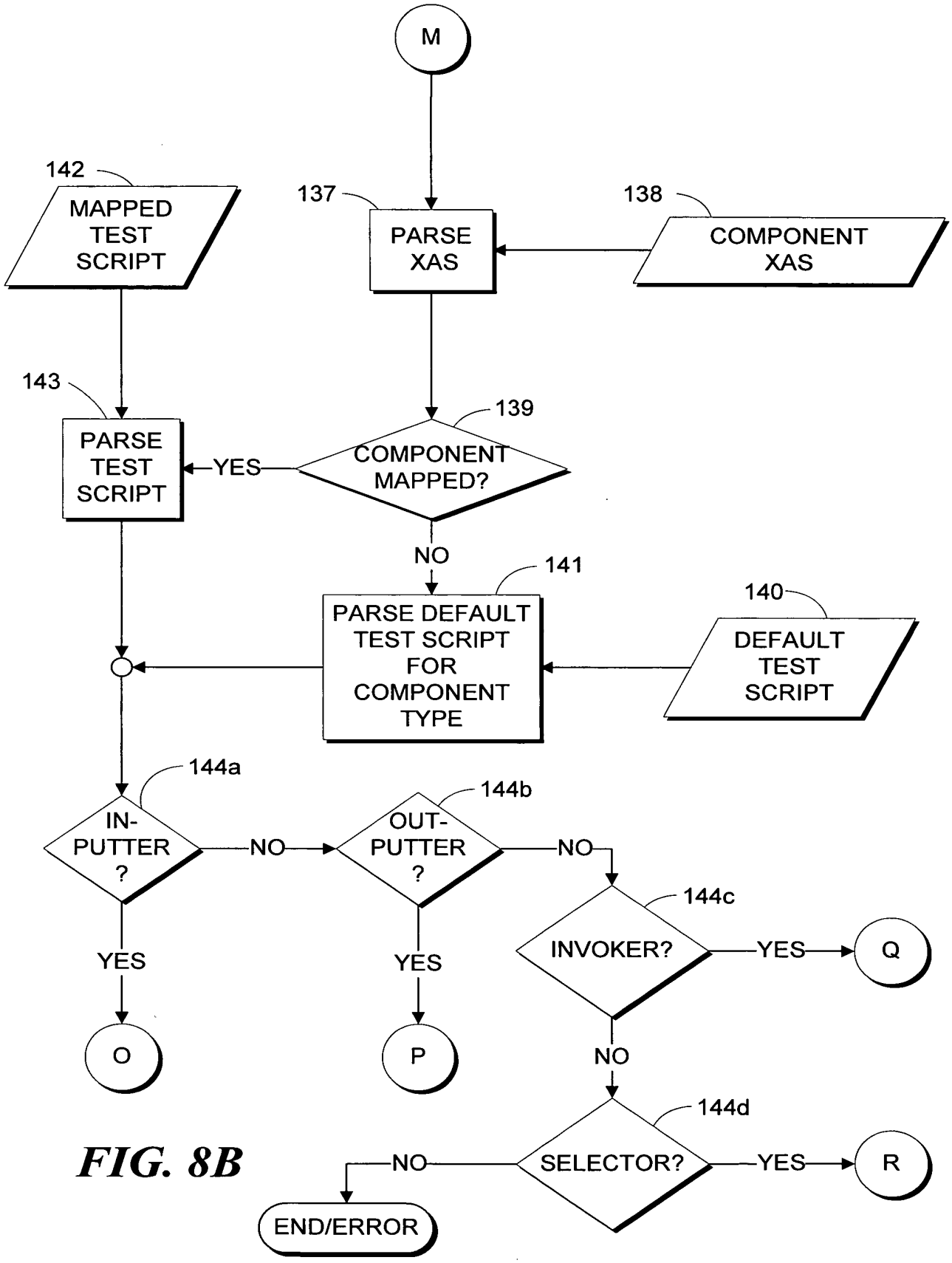
M
142
MAPPED TEST SCRIPT
137
PARSE XAS
138
COMPONENT XAS
143
PARSE TEST SCRIPT
YES
139
COMPONENT MAPPED?
NO
141
PARSE DEFAULT TEST SCRIPT FOR COMPONENT TYPE
140
DEFAULT TEST SCRIPT
144a
IN-PUTTER ?
NO
144b
OUT-PUTTER ?
NO
144c
INVOKER?
YES
Q
YES
O
YES
P
NO
144d
SELECTOR?
NO
YES
R
END/ERROR

FIG. 8B

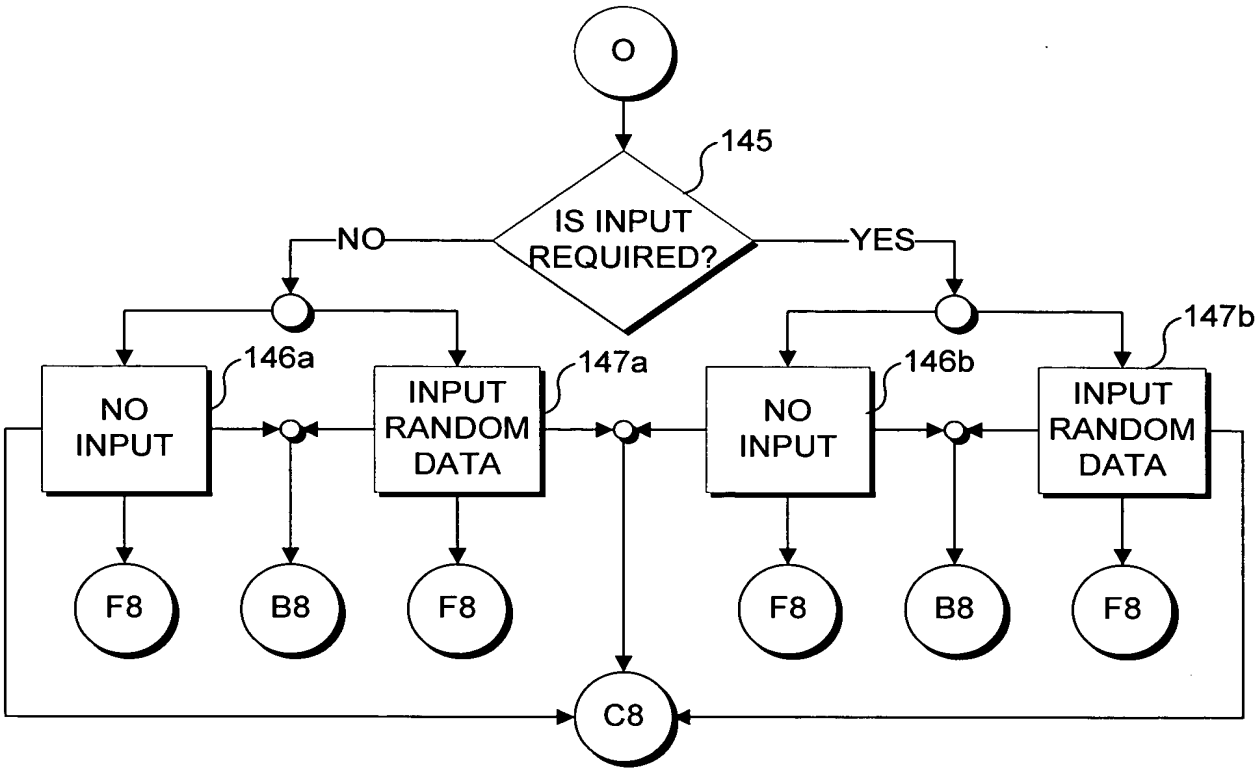
O
145
IS INPUT REQUIRED?
NO
YES
147b
146a
147a
146b
NO INPUT
INPUT RANDOM DATA
NO INPUT
INPUT RANDOM DATA
F8
B8
F8
F8
B8
F8
C8

FIG. 8C

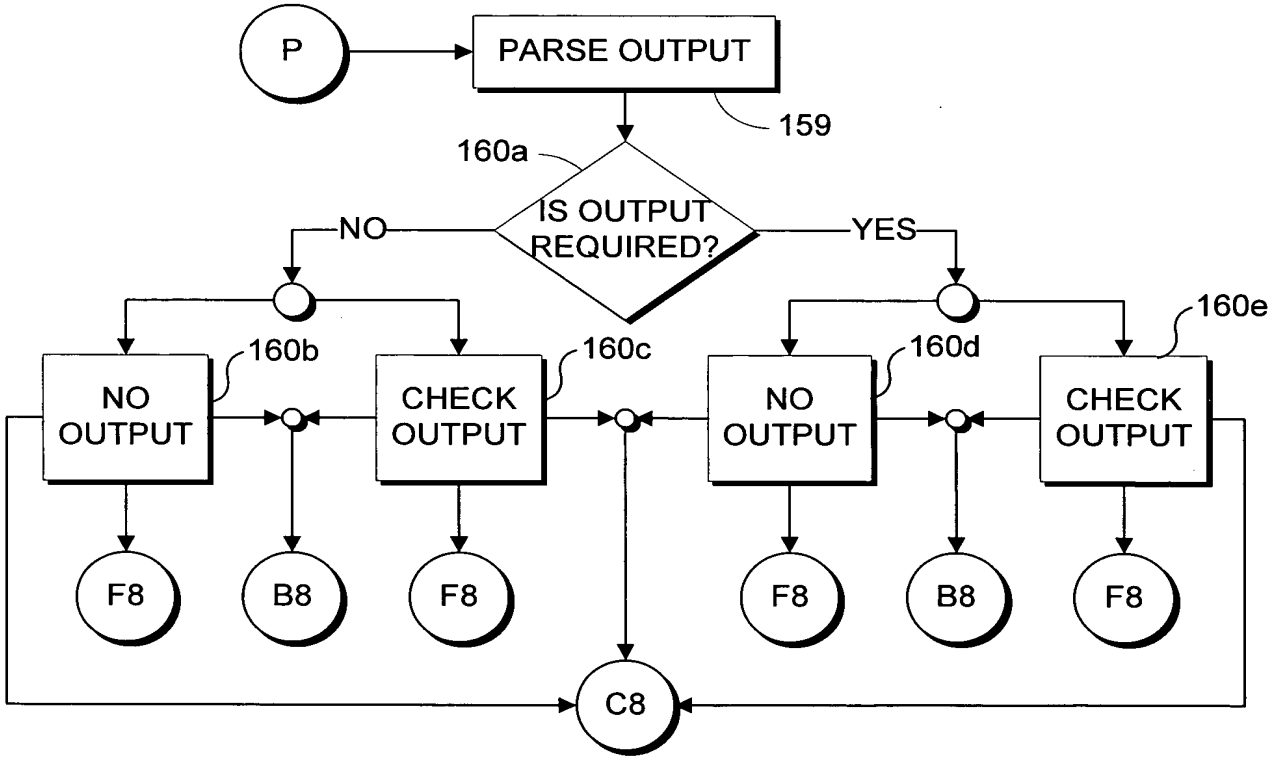
P
PARSE OUTPUT
159
160a
IS OUTPUT REQUIRED?
NO
YES
160e
160b
160c
160d
NO OUTPUT
CHECK OUTPUT
NO OUTPUT
CHECK OUTPUT
F8
B8
F8
F8
B8
F8
C8

FIG. 8D

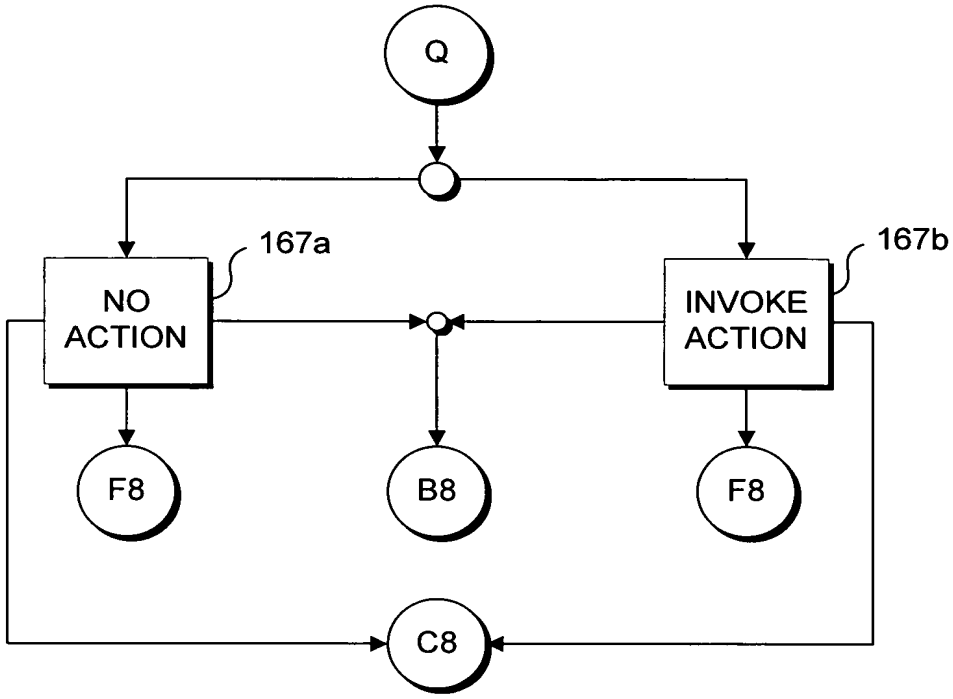
Q
167a
NO ACTION
167b
INVOKE ACTION
F8
B8
F8
C8

FIG. 8E

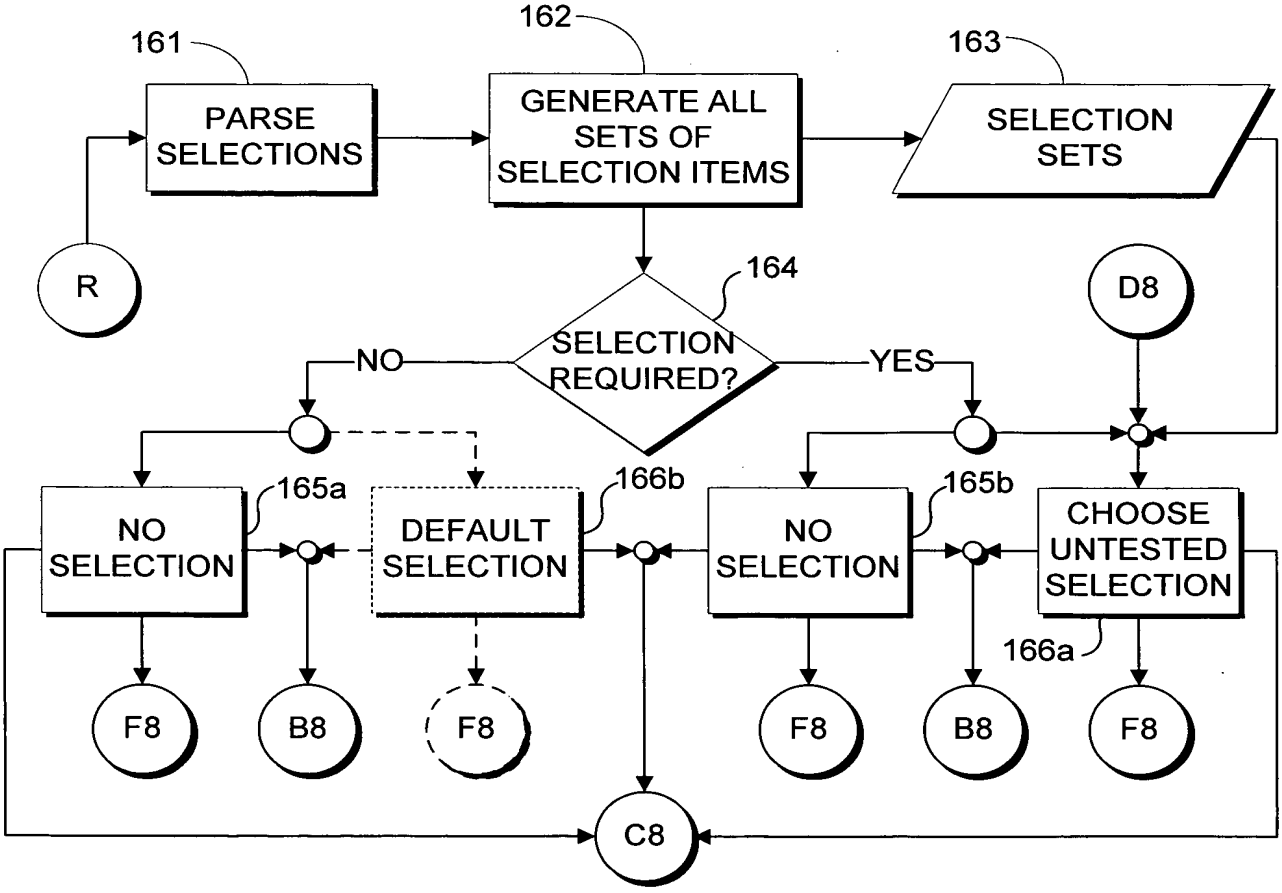
161
PARSE SELECTIONS
162
GENERATE ALL SETS OF SELECTION ITEMS
163
SELECTION SETS
R
164
SELECTION REQUIRED?
D8
NO
YES
165a
NO SELECTION
166b
DEFAULT SELECTION
165b
NO SELECTION
CHOOSE UNTESTED SELECTION
166a
F8
B8
F8
F8
B8
F8
C8

FIG. 8F

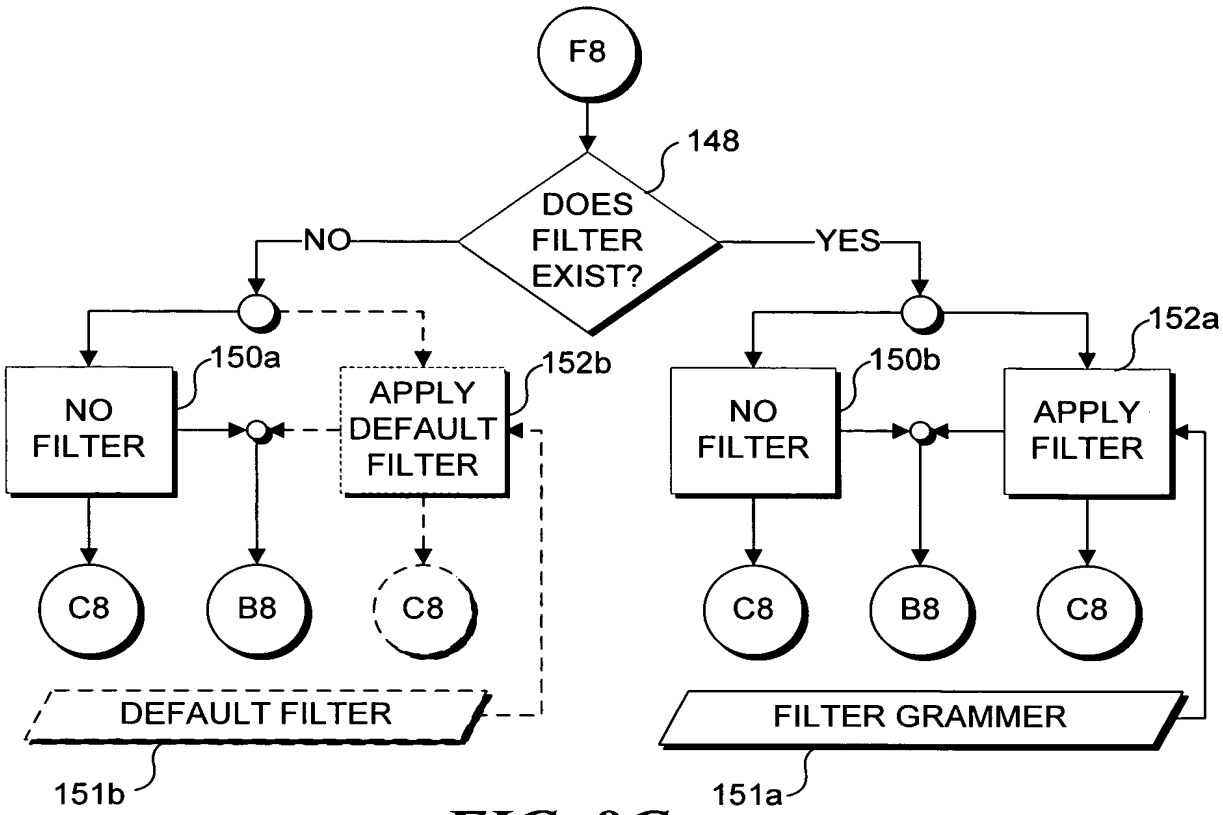
F8
148
DOES FILTER EXIST?
NO
YES
150a
NO FILTER
152b
APPLY DEFAULT FILTER
152a
150b
NO FILTER
APPLY FILTER
C8
B8
C8
C8
B8
C8
DEFAULT FILTER
FILTER GRAMMER
151b
151a

FIG. 8G

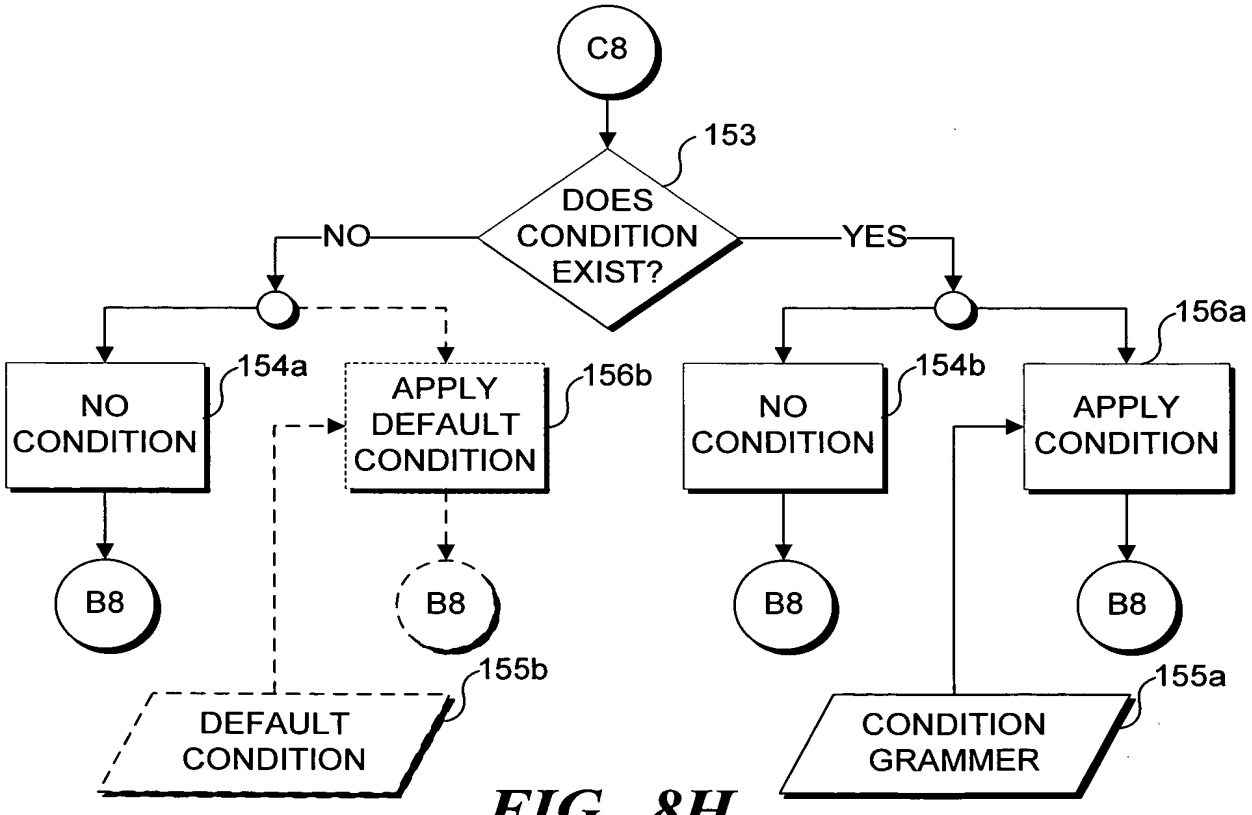
C8
153
DOES CONDITION EXIST?
NO
YES
154a
NO CONDITION
156b
APPLY DEFAULT CONDITION
156a
154b
NO CONDITION
APPLY CONDITION
B8
B8
B8
B8
155b
DEFAULT CONDITION
155a
CONDITION GRAMMER

FIG. 8H

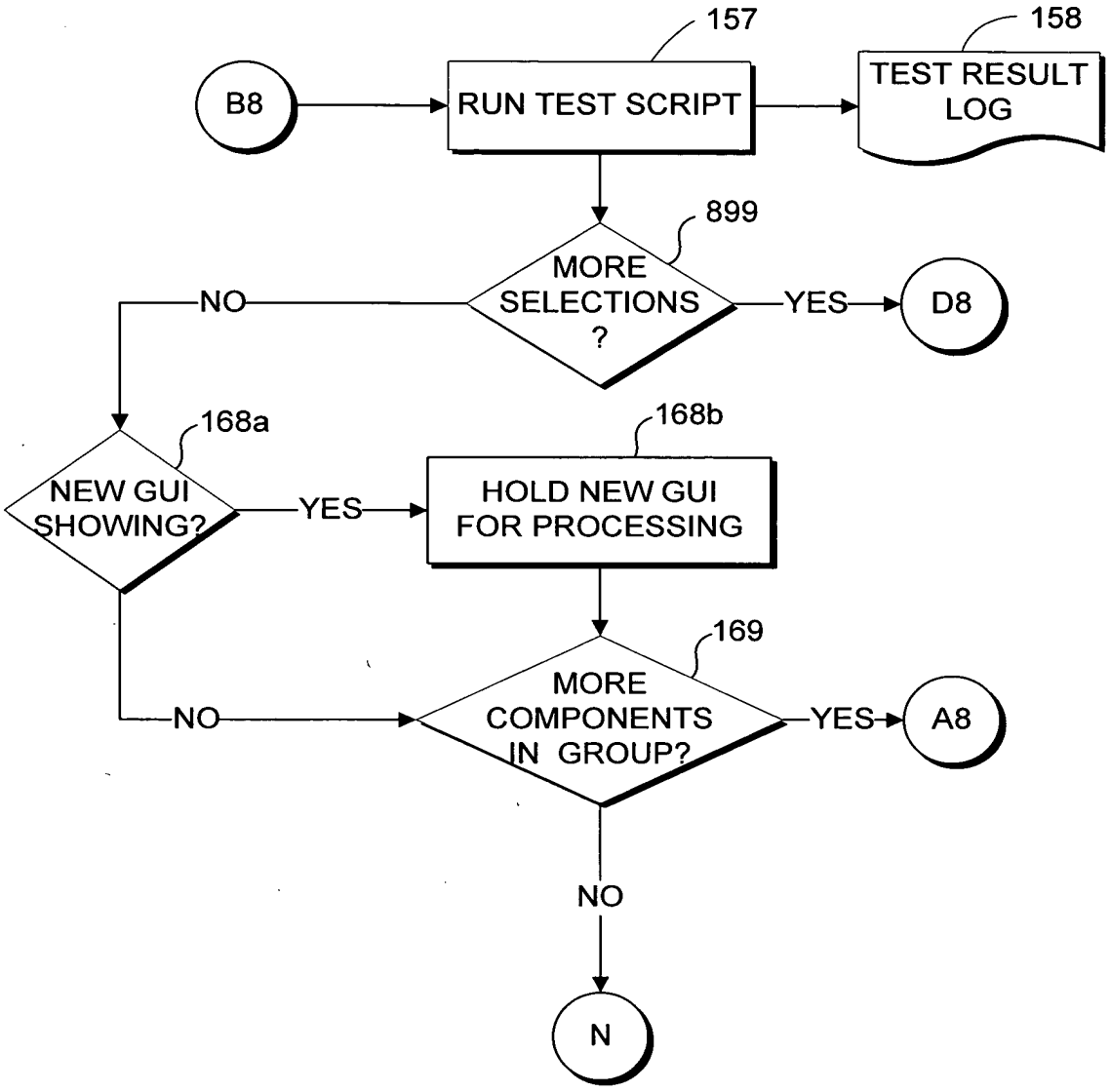
157
158
B8
RUN TEST SCRIPT
TEST RESULT LOG
899
MORE SELECTIONS ?
NO
YES
D8
168a
168b
NEW GUI SHOWING?
YES
HOLD NEW GUI FOR PROCESSING
169
MORE COMPONENTS IN GROUP?
NO
YES
A8
NO
N

FIG. 8I

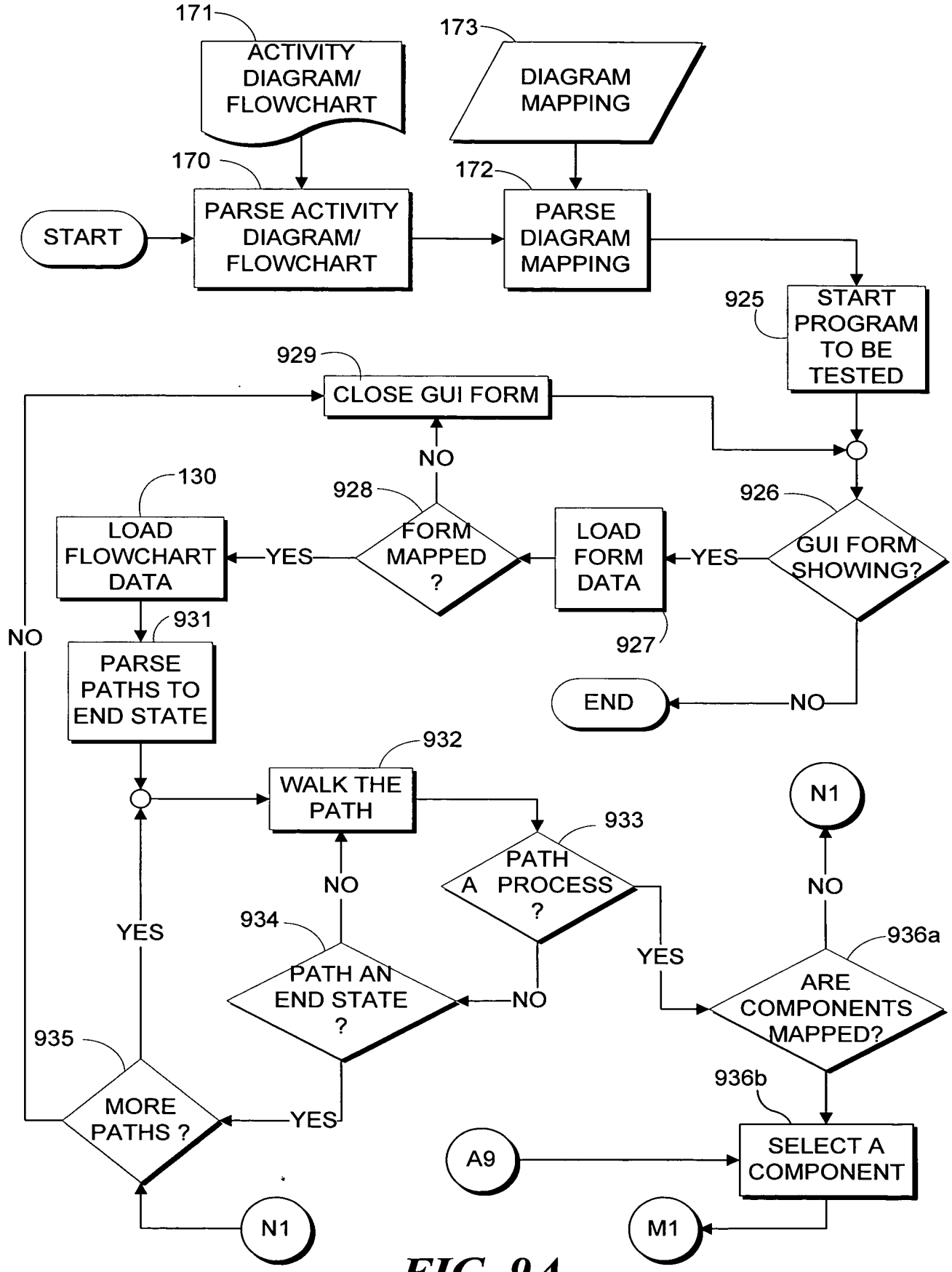
171
ACTIVITY DIAGRAM/ FLOWCHART
173
DIAGRAM MAPPING
170
172
START
PARSE ACTIVITY DIAGRAM/ FLOWCHART
PARSE DIAGRAM MAPPING
925
START PROGRAM TO BE TESTED
929
CLOSE GUI FORM
NO
130
928
926
LOAD FLOWCHART DATA
YES
FORM MAPPED ?
LOAD FORM DATA
YES
GUI FORM SHOWING?
NO
931
927
NO
PARSE PATHS TO END STATE
END
NO
932
WALK THE PATH
933
N1
PATH A PROCESS ?
NO
NO
YES
934
936a
YES
PATH AN END STATE ?
NO
ARE COMPONENTS MAPPED?
935
936b
MORE PATHS ?
YES
A9
SELECT A COMPONENT
N1
M1

FIG. 9A

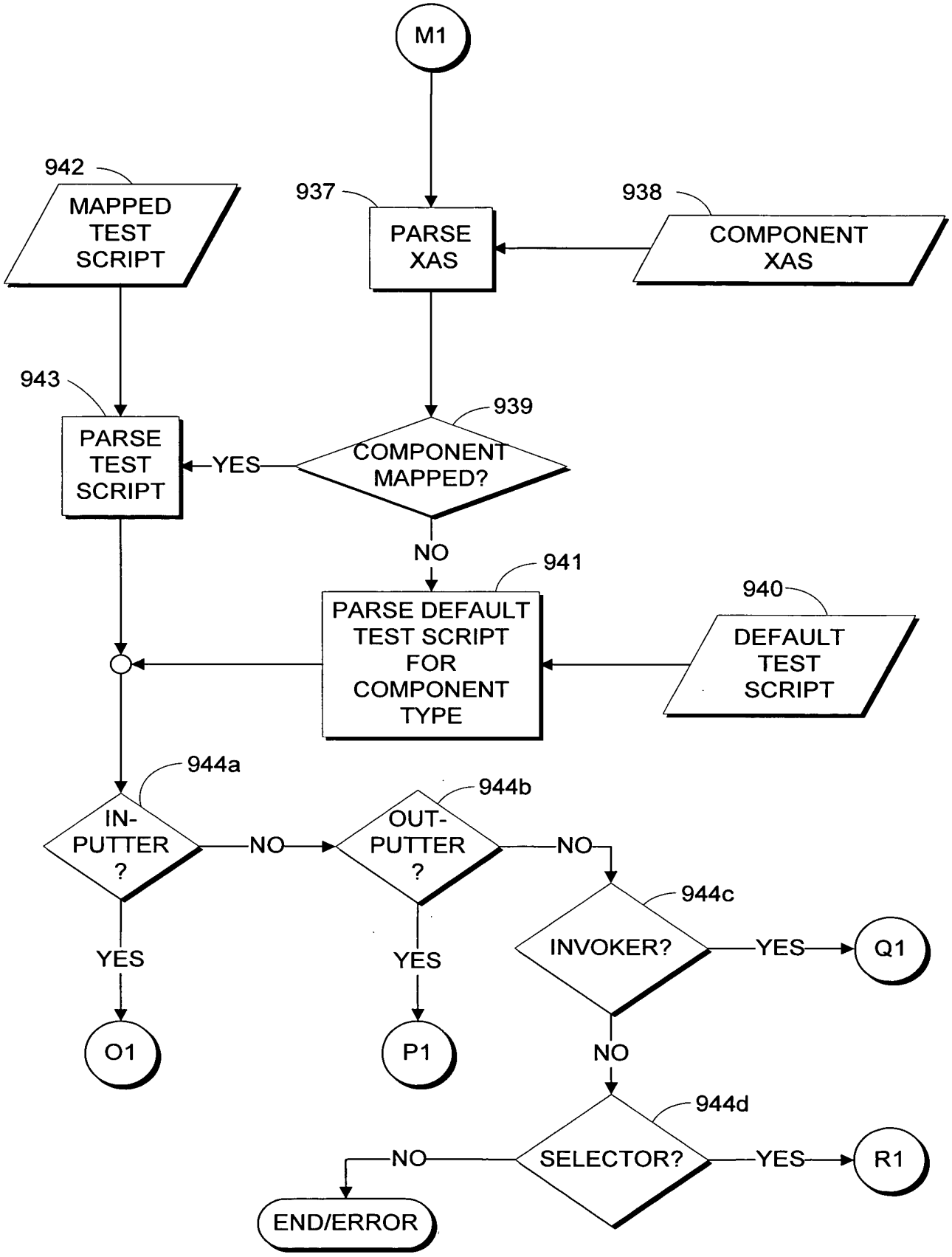
M1
942
MAPPED TEST SCRIPT
937
PARSE XAS
938
COMPONENT XAS
943
PARSE TEST SCRIPT
YES
939
COMPONENT MAPPED?
NO
941
PARSE DEFAULT TEST SCRIPT FOR COMPONENT TYPE
940
DEFAULT TEST SCRIPT
944a
IN-PUTTER ?
NO
944b
OUT-PUTTER ?
NO
944c
INVOKER?
YES
Q1
YES
O1
YES
P1
NO
944d
SELECTOR?
NO
YES
R1
END/ERROR

FIG. 9B

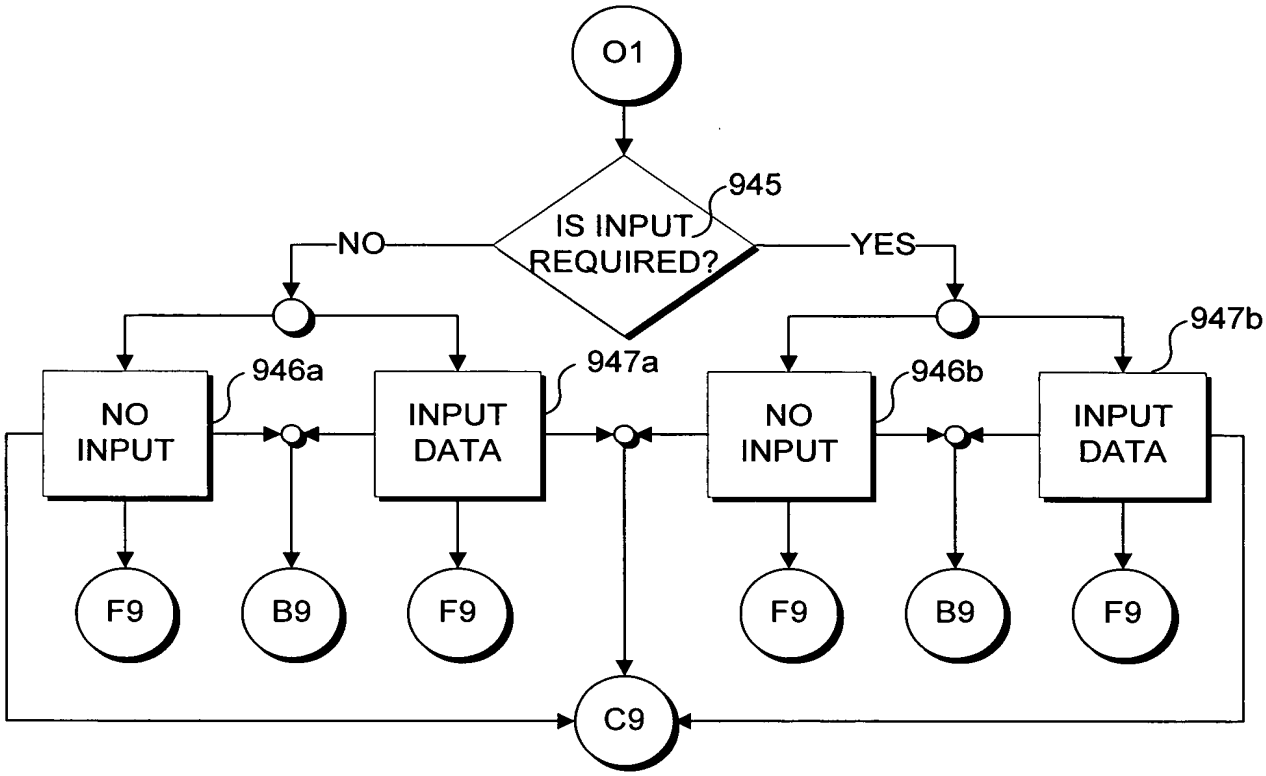

FIG. 9C

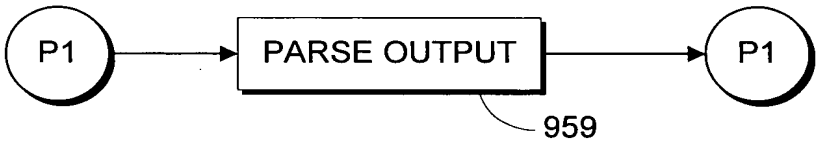

FIG. 9D

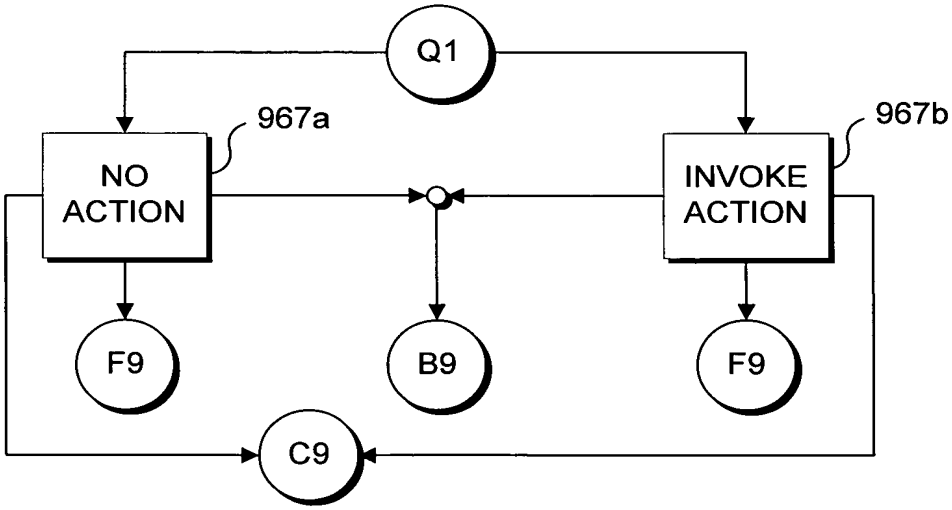

FIG. 9E

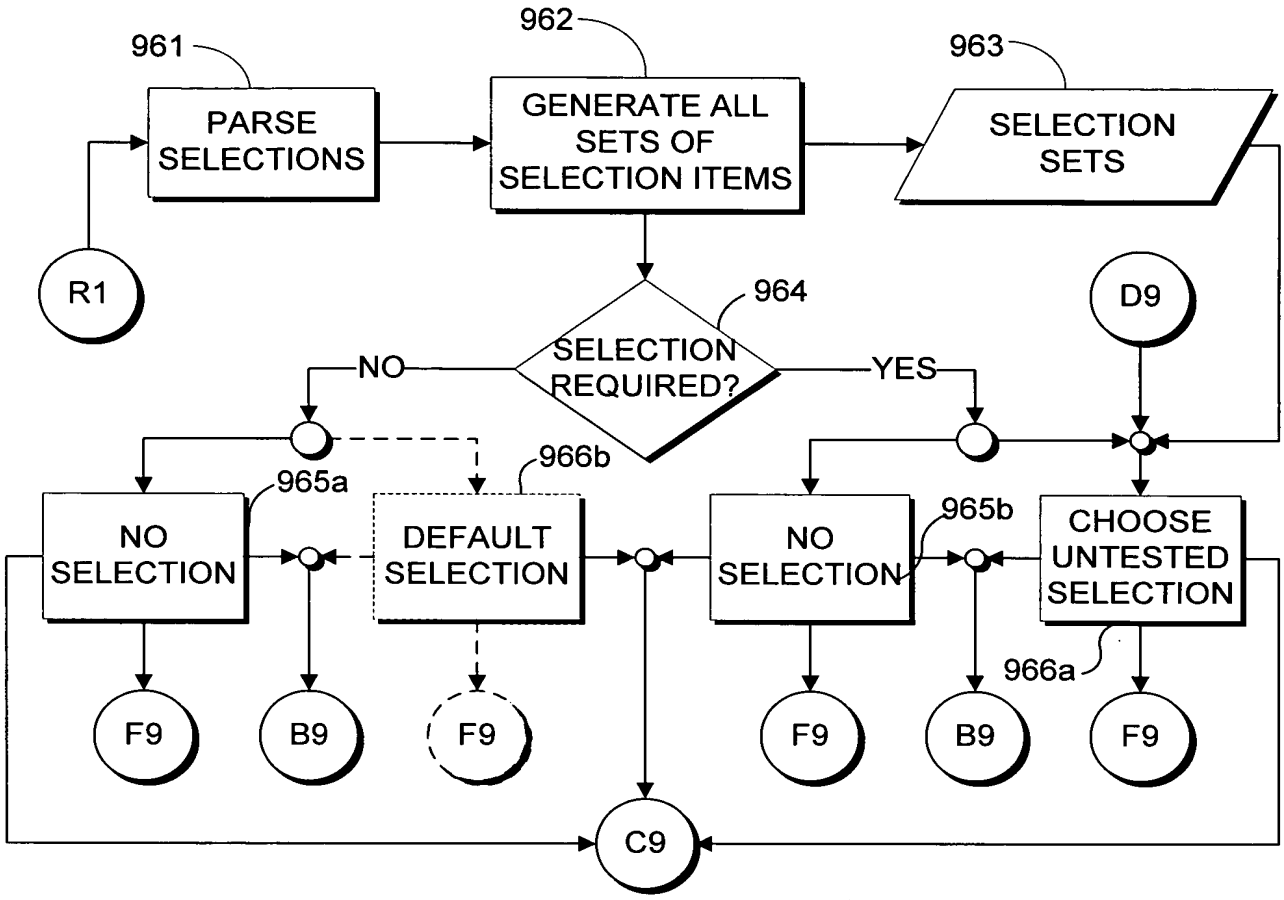
961
PARSE SELECTIONS
962
GENERATE ALL SETS OF SELECTION ITEMS
963
SELECTION SETS
R1
964
SELECTION REQUIRED?
NO
YES
D9
965a
NO SELECTION
966b
DEFAULT SELECTION
NO SELECTION
965b
CHOOSE UNTESTED SELECTION
966a
F9
B9
F9
F9
B9
F9
C9

FIG. 9F

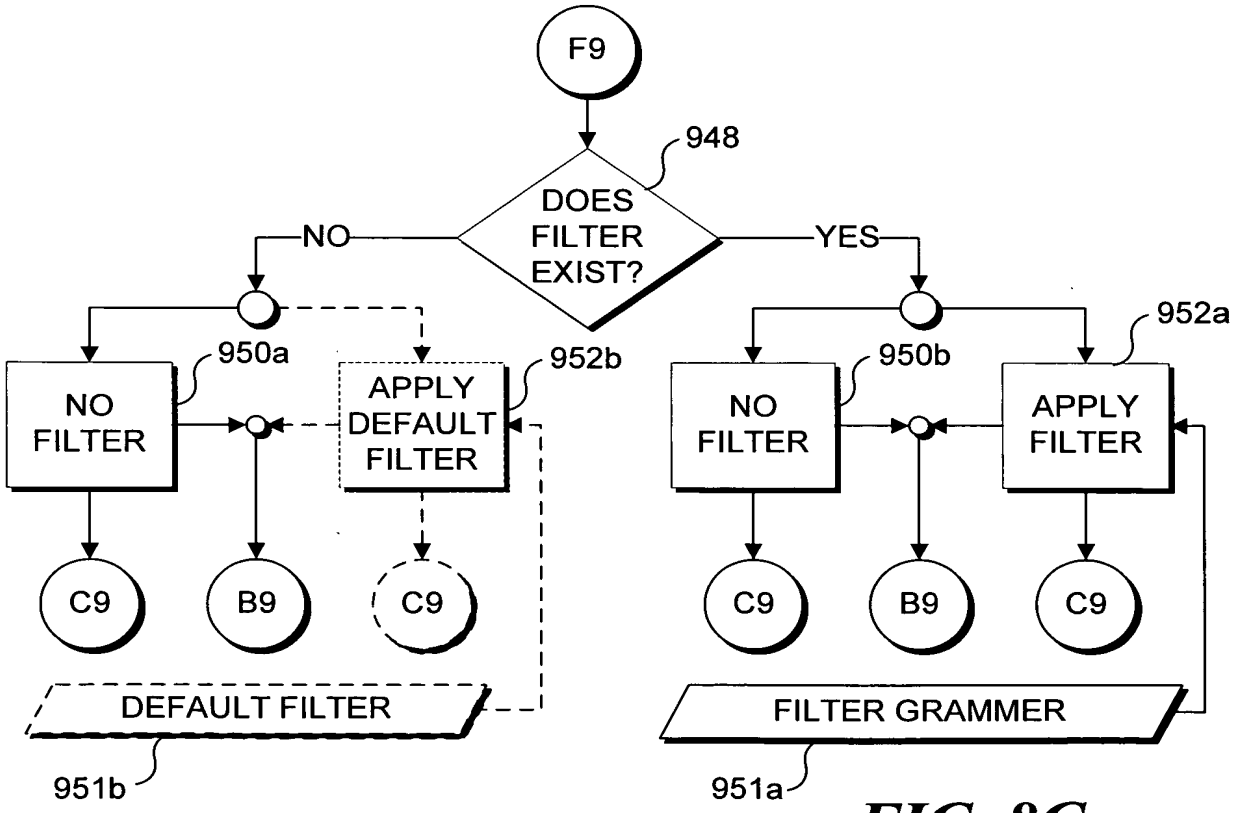
F9
948
DOES FILTER EXIST?
NO
YES
950a
NO FILTER
952b
APPLY DEFAULT FILTER
952a
950b
NO FILTER
APPLY FILTER
C9
B9
C9
C9
B9
C9
DEFAULT FILTER
FILTER GRAMMER
951b
951a

FIG. 8G

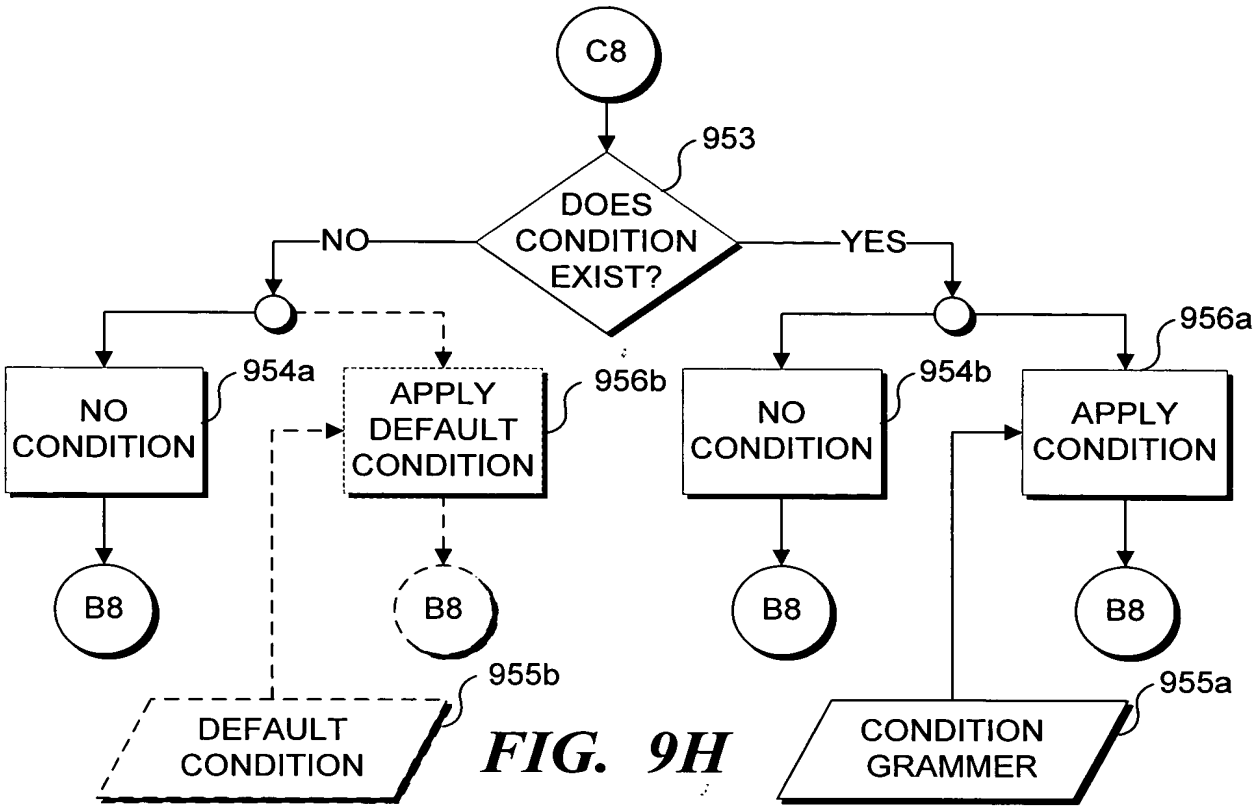
C8
953
DOES CONDITION EXIST?
NO
YES
NO CONDITION
954a
APPLY DEFAULT CONDITION
956b
NO CONDITION
954b
APPLY CONDITION
956a
B8
B8
B8
B8
DEFAULT CONDITION
955b
CONDITION GRAMMER
955a

FIG. 9H

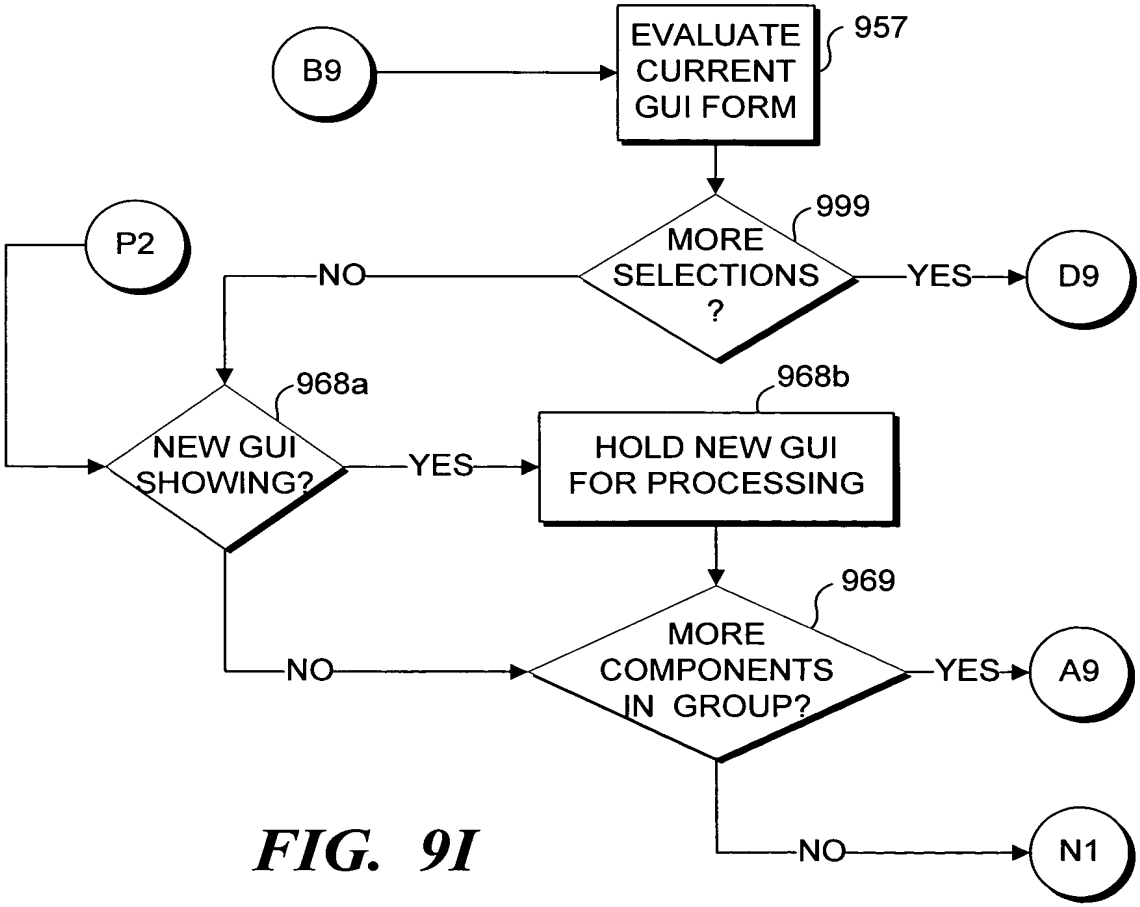
B9
EVALUATE CURRENT GUI FORM
957
P2
MORE SELECTIONS ?
999
NO
YES
D9
NEW GUI SHOWING?
968a
YES
HOLD NEW GUI FOR PROCESSING
968b
MORE COMPONENTS IN GROUP?
969
NO
YES
A9
NO
N1

FIG. 9I

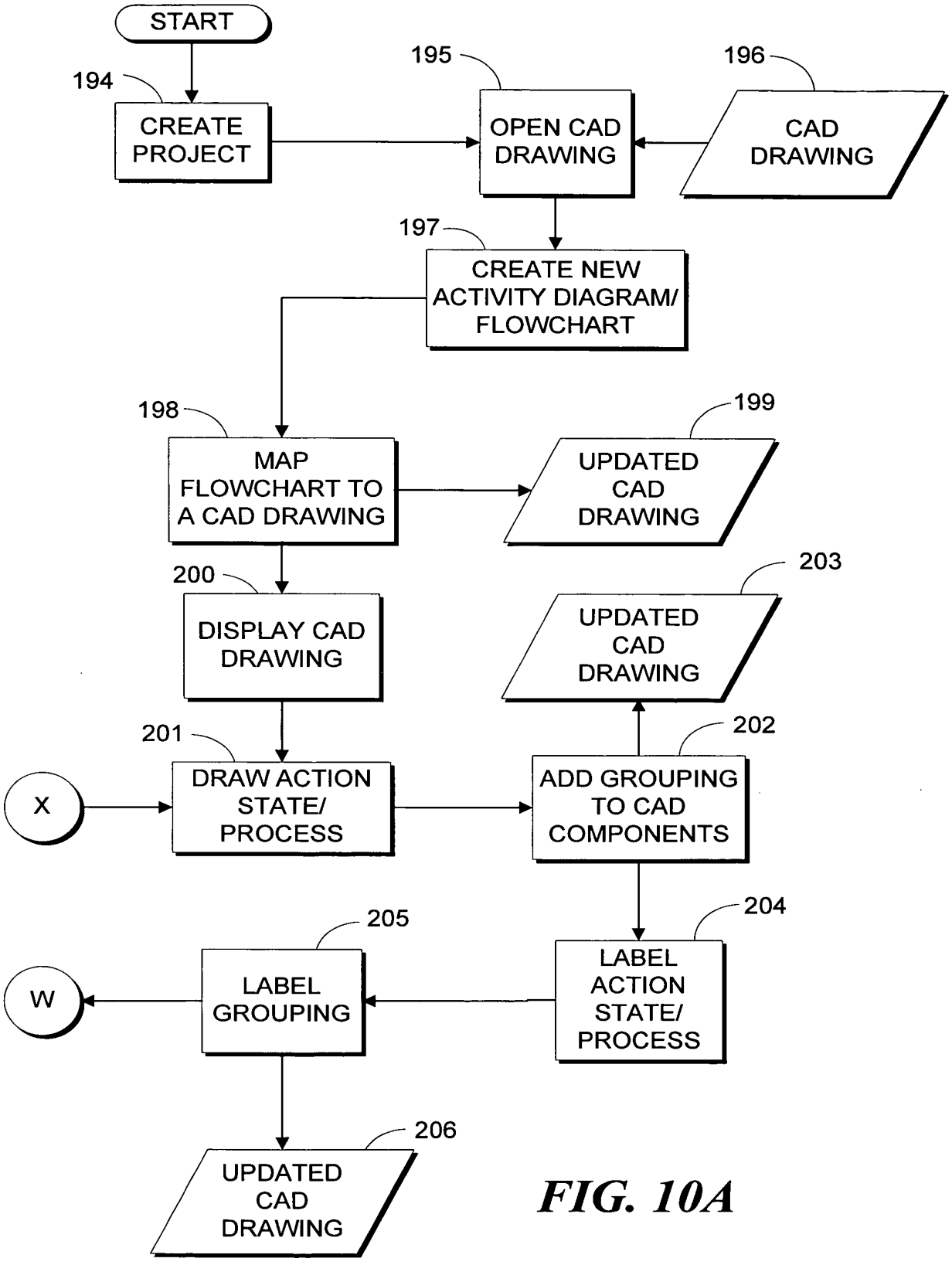
START
194
CREATE PROJECT
195
OPEN CAD DRAWING
196
CAD DRAWING
197
CREATE NEW ACTIVITY DIAGRAM/ FLOWCHART
198
MAP FLOWCHART TO A CAD DRAWING
199
UPDATED CAD DRAWING
200
DISPLAY CAD DRAWING
203
UPDATED CAD DRAWING
201
DRAW ACTION STATE/ PROCESS
202
ADD GROUPING TO CAD COMPONENTS
X
204
LABEL ACTION STATE/ PROCESS
205
LABEL GROUPING
W
206
UPDATED CAD DRAWING

FIG. 10A

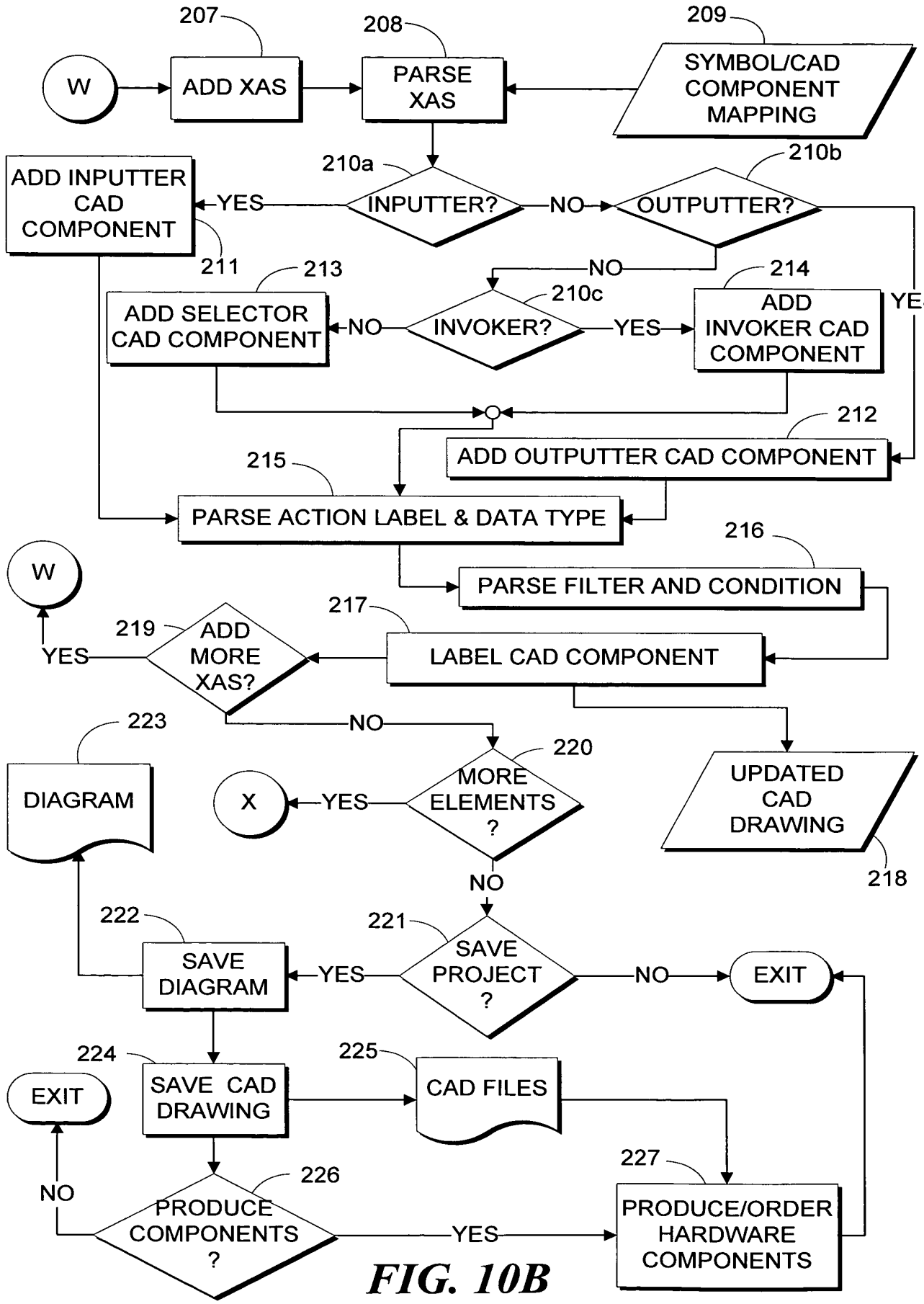
207
208
209
W
ADD XAS
PARSE XAS
SYMBOL/CAD COMPONENT MAPPING
210a
210b
ADD INPUTTER CAD COMPONENT
YES
INPUTTER?
NO
OUTPUTTER?
211
213
214
NO
210c
ADD SELECTOR CAD COMPONENT
NO
INVOKER?
YES
ADD INVOKER CAD COMPONENT
YES
212
ADD OUTPUTTER CAD COMPONENT
215
PARSE ACTION LABEL & DATA TYPE
216
W
PARSE FILTER AND CONDITION
217
219
ADD MORE XAS?
YES
LABEL CAD COMPONENT
NO
223
220
DIAGRAM
X
YES
MORE ELEMENTS ?
UPDATED CAD DRAWING
218
NO
222
221
SAVE DIAGRAM
YES
SAVE PROJECT ?
NO
EXIT
224
225
EXIT
SAVE CAD DRAWING
CAD FILES
227
226
NO
PRODUCE COMPONENTS ?
YES
PRODUCE/ORDER HARDWARE COMPONENTS

FIG. 10B